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AVIATION

The Oldest American Aeronautical Magazine

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AVIATION

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Contents for February, 1936

Volume 15 Number 2

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ALCOA ALUMINUM

HOWARD HUGHES and the WRIGHT CYCLONE Establish a New TRANSCONTINENTAL RECORD

All transcontinental speed records were shattered on January 14, 1936, when Howard Hughes completed a non-stop flight from Los Angeles to New York in a stock model Northrop Gamma monoplane powered by a new Wright Cyclone—in the phenomenal time of 9 hours, 25 minutes and 10 seconds. His average speed was 263.5 miles per hour.

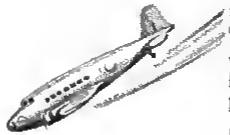
The Wright Cyclone Engine installed in his plane is the latest production type being built to U. S. Army specifications. It develops 930 horsepower for take-off at sea level, and has the highest horsepower rating, both at sea level and at high altitudes, of any single-row, radial air-cooled engine in the world—due to an exclusive Wright supercharger control development.

The great efficiency of the Northrop Gamma-Wright Cyclone combination is illustrated by the fact that Hughes started from Los Angeles with a fuel load of 690 gallons of gasoline and had approximately 225 gallons remaining in his tanks upon arrival at New York.

Low fuel consumption, characteristic of the new Wright Cyclone Engine, at high horsepower, was demonstrated on this flight by the fact that the 465 gallons of gasoline consumed included the warm-up, full load take-off, climb to high altitude and maneuvering after crossing the finish line—as well as the actual transcontinental flight.

WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY
A DIVISION OF CURTISS-WRIGHT CORPORATION

AVIATION *for February, 1936*



▶▶FOR THE FIRST TIME in almost eight years the West Coast is having an aircraft show—a sure 'nough exposition, complete with booths, bunting, brass bands and broadcasting. And it has taken more than a little courage to undertake the job for certainly there has been little in the history of the aircraft exhibitions of the past few years to encourage any one to try it. Orchids, then, to Harry Wetzel, to the Hendersons, and to the supporting committee for making it possible for the aircraft industry to show the world that it has not stood still during the depression years—that it is now ready to go forward at an accelerated pace.

Smartest idea, perhaps, is the combination aircraft and motorboat showing. We have long felt that the airplane is much more akin to the boat, both in marketing possibilities and in method of use, than to any other form of private transportation. We are scarcely qualified to discuss the marine angles of the show. We leave that to our seagoing contemporaries. Of necessity, we go to press long before the doors of the Pan Pacific Auditorium open, but enough information is at hand to give a reasonably accurate preview of the aeronautical end of the exposition.

The roll-call of the aircraft manufacturers reveals that . . . Beech of Wichita will probably exhibit both Wright and Jacobs powered Beechcraft . . . Douglas plans to show publicly for the first time the largest land transport, the DC-3 (page 35) . . . Fairchild (through its local representative) will show a Model 24 . . . Gyro Airlines of Denver expects to exhibit the twin Menasco-powered Crusader . . . Kinner of Glendale, in addition to its engine exhibit, will show the four-place Envoy, the 160-hp Playboy (two-place cabin), and the Sportwing, 160-hp two-place monoplane . . . Lockheed plans public showing of the latest Electra . . . Porterfield of Kansas City will have its latest two-place tandem cabin monoplane with LeBlond engine on view . . . The Rose Parrakeet (Rose Airplane Corp., Chicago) will probably be seen . . . Ryan of San Diego will show the 125-hp, Menasco-powered S T . . . Spartan of Tulsa has a new project under way which may be completed in time for exhibit . . . Stinson Aircraft plans a showing of its latest models of the Lycoming-powered Reliants . . . United Aircraft will include models and photographs of Sikorsky and Chance Vought

Although the four pictures to the right were taken at the 1935 Detroit Show, they are typical of the exhibits on display at Los Angeles. United's booth will include Pratt & Whitney, Hamilton Standard, Sikorsky, and Chance Vought. All Bendix subsidiaries are grouped in one exhibit.

Wright Aeronautical exhibit will include a cut-away geared Cyclone and a seven-cylinder Whirlwind with automatic valve gear lubrication and other new equipment. Air Associates booth will include a wide range of well-known aeronautical products.

Latest in Western Electric aircraft receivers

Western Electric aircraft transmitter

. . . SHOW PREVIEW

airplanes . . . Waco plans to exhibit 1936 versions of all models . . . Taylor Aircraft (through distributors) will show the latest in "Cubs."

Among the engine builders . . . Kinner plans its exhibit around the new 370-hp SC-7 (page 46) the R-5 Series 2, and the 125-hp B-5 . . . Menasco is scheduled to be on the floor with a full line of late models . . . Pratt & Whitney will show a cutaway twin Wasp, also a twin Wasp Jr., provided government permission is forthcoming . . . Wright exhibit will include a cutaway Cyclone also the latest seven-cylinder Whirlwind with automatic valve gear lubrication . . . Continental Motors plans to show its most recent aircraft engine models.

The parts and accessory people report that . . . Air Associates will have an extensive exhibit . . . Bendix will show current carburetor models and the Automatic Mixture Control . . . Berry Bros. will have on hand their color panels and model airplanes . . . Cleveland Pneumatic Tool will show Aerol struts (with Air Associates) . . . Eclipse starters, generators, etc., will form a part of the Bendix exhibit . . . Elastic Stop Nut will exhibit a full line of fastening devices . . . Hayes Industries (Autofan) will participate with Air

Menasco Buccaneer

Sumnerill's lobe-drawing exhibit

RCA aircraft and airport radio equipment

Associates . . . A complete line of Kollsman Instruments will be on view . . . Norma-Hoffmann will feature aircraft anti-friction bearings . . . Pioneer Instrument exhibit will include examples of its complete line, many of them panel-mounted . . . Scintilla will show magnetos, battery ignition sets and switches . . . Summerill will demonstrate tube manufacturing on a miniature draw bench, will feature bright surface finishes . . .

In the communications field . . . RCA plans to show a full line of airport communication equipment, including a new air traffic control transmitter, and aircraft receivers for private owners, possibly also a new radio compass and two new aircraft transmitters . . . Western Electric will display for the first time a new all-purpose, four-band airplane radio receiver, a three-frequency airplane radio telephone transmitter, also five-watt, two-way telephone equipment.

In the tire and rubber field . . . General is reported showing its line of Streamline tires . . . Goodyear will exhibit Airwheels and other aeronautical products . . . Among exhibitors of fuels, lubricants and allied products are . . . Standard of California . . . Shell Oil . . . MacMillan Oil . . . Union Oil.

A number of airlines are represented,—WAE, American, TWA and United . . . Grand Central, Union Air Terminal and Los Angeles Municipal airports have taken space.

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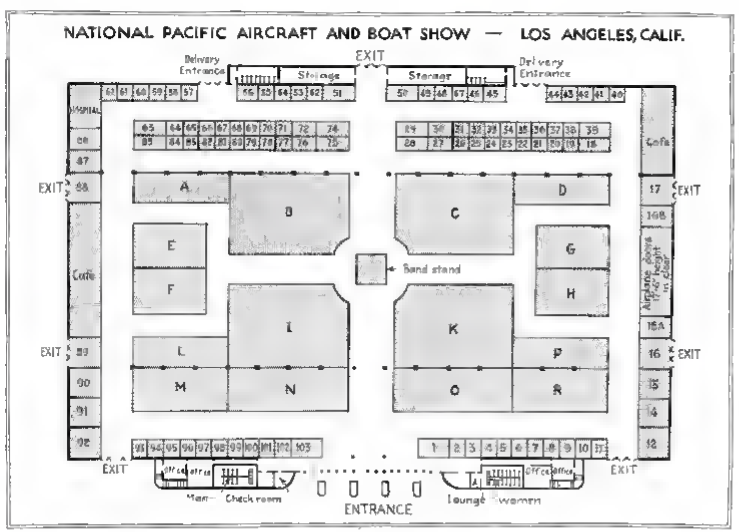
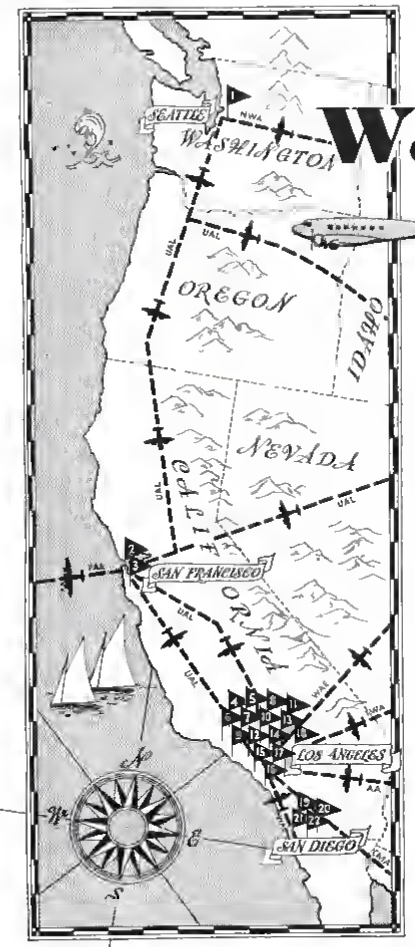
Aeronautical Exhibitors

Aviation will be at home in Booth 49

B Kinner Airplane & Motor Corp. Ltd
C Douglas Aircraft Co
D Fairchild Aircraft Corp (F A Galligan).
G United Air Services Ltd
H. Waco Aircraft Co.
I MacMillan Oil Co
L Lockheed Aircraft Corp
K. The Northrop Corp
K. Airplane Development Corp
Edo Aircraft Corp
M. Security National Aircraft Corp.
M. Taylor Aircraft Co
N Porterfield Aircraft Corp
N Beech Aircraft Co.
O Stinson Aircraft Corp
O Gyro Airlines Inc
R. Ryan Aeronautical Co.
1-3 Aircraft Industries, Inc
4-6 Wright Aeronautical Corp
6A. Charles Babb
7 Precision Bearings
8-8 Nicholas-Beazley Airplane Co
10-11 Kollsman Instrument Co
18A. Menasco Manufacturing Co
16B. Standard Oil Co of California
18-28, 37-39 Pacific Airmotive Corp.
21 Western Electric Co
22-23 American Airlines
24-31 Bendix Aviation and Marine Products
35 *Western Flying*
38 Elastic Stop Nut Corp.
41 Packard Electric Co
42 W F Crowe
45 T W A.
49 Aviation
50 California Panel & Veneer
51 Shell Oil Co.
52 *Aero Digest*
53-70, 72-80 United Airlines.
72 Los Angeles Municipal Airport
74-75 United Aircraft-Pratt & Whitney, Sikorsky, Chance Vought, Hamilton Standard
76-77 Kinner Airplane & Motor Corp.
81-82. Thompson Products Co
130-131 Continental Motors Corp
102 103 Air Associates, Inc.





Westward Ho . . .

WE DON'T KNOW whether it was Horace Greeley who started it, or whether it was just good staff and field work by West Coast Chambers of Commerce, but for whatever reason, several important units of this aviation industry have packed their goods and chattels and turned their faces westward during the past twelve months. Were we living in covered wagon days, or even the Era of the Iron Horse, we who still have our roots in the East might have reason to be seriously alarmed at being left behind. But distances are relative—are only a function of the time it takes to cover them. Today the western seaboard is as close to us as were Chicago, Detroit, or Buffalo five years ago. We cannot feel, therefore, that any movement of the industry from one side of the country to another, east to west or west to east, makes it any less of an integrated whole, or can be any cause for concern. We are glad that aviation is still young enough to be filled with that pioneering spirit that makes a man willing to pull up stakes and move on when the sound of his neighbor's axe becomes too insistent, or when opportunity seems to beckon from far horizons.

This issue, then, is dedicated to our neighbors on the Pacific Coast—to the old settlers, Boeing, Douglas, Kinner, Lockheed, and Menasco—to the newcomers, Consolidated and North American—to all the others who serve the industry in any way. In the following pages of this section we have brought together something of their activities and facilities—something of the men who run them. The individual accounts are necessarily brief, but in the aggregate they make an impressive total. It is plain that between San Diego and Seattle lies a strip of territory that has become an important center for our newest and most important industry.

1, Boeing Aircraft Company, 2 Boeing School of Aeronautics, 3 Heinis & Kaufman, Ltd; 4 The Northrop Corporation; 5 The Douglas Aircraft Company; 6, North American Aviation, Inc.; 7 Lockheed Aircraft Corporation; 8 Pacific Airmotive Corporation; 9, Curtiss-Wright Technical Institute; 10 Airplane Development Corporation; 11 Kinner Airplane & Motor Corporation, Ltd, 12 Timm Aircraft Company, 13 Hughes Products Corporation, Ltd; 14 Nicholas Beazley Airplane Co., Inc.; 15 Air Associates, Inc., 16 Eagle Aircraft Specialties; 17 Menasco Manufacturing Company, 18 Lawrence W. Brown Aircraft Company, 19 Consolidated Aircraft Corporation; 20 Ryan Aeronautical Company, 21 Ryan School of Aeronautics; 22 Solar Aircraft Company, Ltd

DOUGLAS AIRCRAFT COMPANY

Upper left and right: Donald Willis Douglas president, Harry Wetzel, vice-president. Lower left and right Arthur Raymond chief engineer, Carl Cover, vice-president (sales).

THE Douglas Aircraft Company is justly proud of the humble tool shed where Donald Willis Douglas, with extremely modest financial resources, designed and built his first airplane in 1920. And the company is also proud of its steady growth to the present 350,000 sq. ft. of floor space, soon to be doubled. As it enters its sixteenth year the outlook is bright in both commercial and military manufacturing.

Following a long series of successful military designs came the sensational success of the DC-2, first major commercial venture. When a demand came for a larger transport ship, Douglas was ready with a 24,000 lb. sleeper designed for sixteen berths or for 32 or 24 seats when equipped as a day plane. (See page 35.) Test flights are now underway and an order for fifteen ships has been received from American Airlines. Late in December, 1935, the company received a $6,498,000 order from the Air Corps for 90 bombers, following a design competition at Dayton. Still more recently the Navy ordered 114 torpedo planes at a cost of $3,636,000.

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THE NORTHROP CORPORATION

ORGANIZED in 1928 to commercialize the possibilities in the flat-plate, multi-cellular type of wing structure conceived by its president, The Northrop Corporation continued as a subsidiary of United Aircraft and Transport Corporation until the present company was formed. In 1932 it became a subsidiary of the Douglas Aircraft Company, its present status.

Within the past year two large military aircraft contracts for a total of 210 Army attack ships ($4,456,474) have led to concentration of activities on military production for domestic and foreign sale.

The first Northrop Alpha was introduced as a commercial plane in 1929 but the new structural principles were later applied to the design of military pursuit, attack, and light bombing equipment. In the transport field the company is now offering the Gamma and Delta models. Northrop ships have been used in several record breaking flights, including the recent transcontinental hop of Howard Hughes in nine hours and 27 minutes. This ship was originally built for Jacqueline Cochran who planned to use it in the MacRobertson London-Australia race.

John K. Northrop, president, right; W. K. Jay vice-president and general manager, left.

Early Northrop machines were built in the plant of the former Moreland Aircraft Corporation on Los Angeles Municipal Airport, Inglewood, Cal. The present factory is adjacent to the airport and comprises 160,000 sq. ft. of floor space. The normal personnel is about 1,000.

LOCKHEED AIRCRAFT CORPORATION

PROPONENT of high-speed design is the Lockheed Aircraft Company. Founded on the idea of monocoque or skin stressed construction, the first factory was operated by the Loughead brothers, Allan and Malcolm, at Santa Barbara. They moved shortly to Hollywood and changed the spelling of the company name. There the famous "Vega" model was born. Then followed the "Air Express," the "Orion," and a long series of models with astronomical names to which many a famous pilot hitched his reputation, and broke records.

Outgrowing its Hollywood quarters, the plant was moved to Burbank. Wood gave place to metal in the Lockheed structure, and single engined design was replaced by twin engined treatment. Nearly 250 single-engine commercial planes and 50 twin-engine airliners have been turned out at the Burbank factory. In 1935 (Burbank plant's most active year) 40 Electra's ($2,075,000) were built and delivered to airline operators and private individuals. The list of Electra-equipped airlines now includes: Pan American, Northwest, Eastern, Delta, LOT (the Polish line), and a number of others.

A smaller edition of the Electra, suitable for feeder service (page 36) is to be offered for sale in 1936. This is in accord with the present policy of the company to place primary emphasis on the heretofore uncrowded field for the manufacture of transport and commercial planes of ten passenger capacity and under, for supplementary airline service and industrial applications. At present there are about 500 persons engaged in production and research on the Lockheed payroll.

Left to right: Carl B. Squier, vice-president (sales); Cyril Chappellet, secretary; Robert E. Gross president and treasurer.

• • •

AIRPLANE DEVELOPMENT CORPORATION

Left to right: Don P. Smith, president and general manager; Gerard P. Vultee, vice-president and chief engineer.

WHILE others have been thinking in terms of multiplicity of power plants, the Vultee idea to date has been to get high speed transport operation on one engine. While at Lockheed Gerard Vultee carried the frontiers of high speed well forward. In January 1932 his own company was formed as a subsidiary of the Cord Corporation of Chicago, for the purpose of manufacturing commercial and military aircraft. At present the Glendale plant has a productive capacity of 50 planes per year of either the transport or the attack bomber type.

Production on the Vultee V-1A Transport was started late in 1933 and, in 1934 and 1935, 30 of these planes were delivered to American Airlines and to other commercial and private operators. The transport design was modified in 1935 to develop the Model V-11 Attack-Bomber (AVIATION, January 1936), which was completed and flown toward the close of the year.

The Vultee fuselage has been designed for simplified production and ease of maintenance. This is accomplished by the extensive use of a series of flat sheets for covering and preforming is therefore unnecessary.

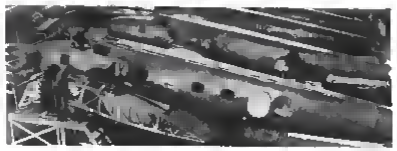
Vultee's engineers have specialized in the design of production machinery adapted to the manufacture of light sheet structures. A considerable investment has been made in forming tools, cutting machinery, rivetting and assembly jigs.

Upper left and right: Claire L. Egtvedt, president; Erik H. Nelson, vice president (sales). Lower left and right: Gardner W. Carr, vice president (manufacturing); C. N. Monteith, vice president and chief engineer.

BOEING AIRCRAFT COMPANY

PRODUCTION in nineteen years of 1,900 airplanes of 60 different types plus a background of detailed innovations too numerous to repeat here are high spots in the background of the Boeing Aircraft Company of Seattle. And all this has been fused into the design of the largest landplane in America—the 15-ton, high speed Boeing 299 Bomber, thirteen of which have been ordered by the Army Air Corps.

Boeing's ships turn up on aircraft carriers, and wherever military airplanes are in use. They are also found in large numbers in operations where passengers, mail and express are to be carried expeditiously. The high-speed twin engined 247's and 247 D's are now flying more than 60,000 miles daily on scheduled airlines. The Seattle plant area is 336,472 sq. ft., about 1,800 persons are normally on the payroll. The company is affiliated with Boeing Aircraft of Canada, Ltd., and the Stearman Aircraft Company.



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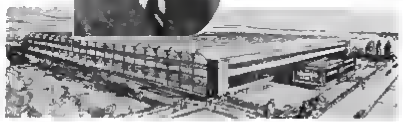
J. H. Kindelberger, president and general manager (Manufacturing Division)



NORTH AMERICAN AVIATION, INC.

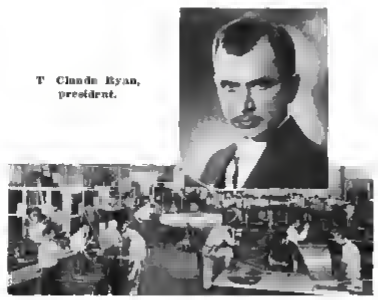
THE Manufacturing Division of North American Aviation, Inc., is the successor, through consolidation, to General Avation Manufacturing Corp., B/J Aircraft Corp., Fokker Aircraft Corporation of America, and Pittsburgh Metalair Corporation. This company has been operating since July, 1934, on the development and production of airplanes for the U. S. Army and Navy. The main factory (160,000 sq. ft.) and general offices are now located on the Los Angeles Municipal Airport at Inglewood, Cal. Production is now under way on 95 advanced training type airplanes for the U. S. Army.

• • •

RYAN AERONAUTICAL COMPANY

IN 1922, long before the days of divorcement of airline operating from aircraft manufacture, the Ryan Air Lines Company flew on schedule between San Diego and Los Angeles and built five-place cabin biplanes to use on its line. The manufacturing enterprise expanded later to include production of monoplanes and the first of these, the M1 was produced in quantities and used by several of the early contract air mail lines. Most famous Ryan—The Spirit of St. Louis, was built in 1927. Then came the Ryan Brougham, a popular model of the late 20's. For the past two years the company has been producing the S-T, a Menasco-powered, low wing sport plane having a metal monocoque fuselage. Location, San Diego.

T. Claude Ryan, president.



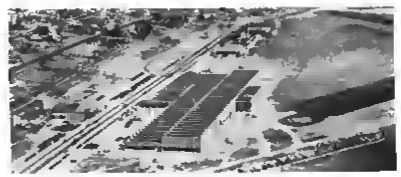
CONSOLIDATED AIRCRAFT CORPORATION

WHENEVER the Navy decides to practice long distance flying, they gas up a squadron or two of Consolidated patrol boats (XP Y series) and send them out. In commercial service these famous ships are known as "Commodores," and are in daily use on certain of the routes of Pan American Airways. Other illustrious members of the Consolidated family are the PT & NY series, the Fleets and Fleetsters.

Most of these designs were conceived when the company was located at Buffalo, N. Y., whence it was moved from East Greenwich, R. I., where it was organized in 1923. The new 250,000 sq. ft. plant on Lindbergh Field, San Diego, Cal. is already at work filling an order for 50 pursuit ships for the Army, 60 patrol boats (XP3Y) for the Navy. At present 1,450 men are working.

Maj. Reuben Fleet, president

Left to right: R. S. Madleon, Lt. Cmdr. D. M. Carpenter, T. M. Ladden, R. A. Miller, H. A. Sutton, R. E. Overamith, J. L. Kelley, George Newman, Jr., C. T. Leigh, C. A. Van Dusen, Capt. L. C. Hurd, E. F. Neff.



The new plant is of sawtooth construction providing a maximum degree of lighting for the assembly floors. A carefully planned production flow is provided. Materials unloaded at the spur track at the southeast corner move northward through the center bays for fabrication and the fabricated parts move southward through a higher bay for partial and final assembly, thence out to the flying field for testing.

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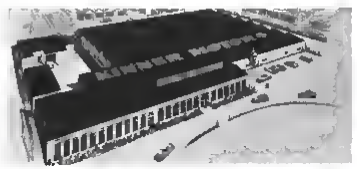
KINNER AIRPLANE & MOTOR CORPORATION, LTD.

REALIZING the need for an engine to replace the OX-5, the Kinner Corporation (founded in 1919, reorganized in 1928 under Robert Porter, present head) developed its now familiar 100 hp. model, obtaining orders for about 2,000 units. Reaching up into the higher horsepower ranges, engines of 125, 160 and 210 hp. were developed. Anticipating demand for much larger engines, a series ranging from 300-1,000 hp. has been designed and built during the past two years. Airplanes made by Kinner range from a 100 hp. sportster to a twin-engined, eight-place, feeder line ship with 2-370 hp. supercharged engines. The plant is located in a leased building near the Grand Central Air Terminal and has nearly 40,000 sq. ft. of floor space. Productive capacity is above 300 engines per month.



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TIMM AIRCRAFT COMPANY

Otto Timm, above; W. D. Timm, right.

WITH their history dating back to the days of bamboo structures, Otto and W. D. Timm have designed and built a long series of ships ranging from early pushers down to the Timm Collegiate of several years ago. Their latest conception—a five six-place twin engined monoplane for feeder service is now in the engineering stages. Interest in this type of airplane has been stimulated by the recent Department of Commerce specification, and plans are under way for early production.

For the past five years the Timm brothers have been engaged in aircraft repair and reconstruction. In 1934 they moved to Grand Central Terminal.

MENASCO MANUFACTURING COMPANY

A. S. Menasco, president

The present Menasco Manufacturing Company is a California corporation formed in June, 1934, to take over the previous unincorporated company operating under the same firm name. Officers are A. S. Menasco, president; Charles F. McReynolds, secretary. Directors include A. S. Menasco, Charles F. McReynolds, and Wm. Keith Scott. The factory has a total floor space of about 30,000 sq. ft. and operates its own aluminum foundry. It is in Los Angeles.

MENASCO inverted in-line air-cooled engines have been manufactured continuously for about eight years. Production now exceeds ten engines per month. Fourteen different American aircraft manufacturers offer planes powered with them. Menasco engines are also used in many foreign countries. Six commercial models (four and six cylinders) are now offered, ranging from 95 to 250 hp.

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HEINTZ & KAUFMAN, LTD.

Ralph M. Heintz, president, left; Jack Kaufman, vice-president and treasurer, right.

FOUNDATIONS for the present Heintz & Kaufman, Ltd., were laid in 1919 in the old Radio and Scientific Apparatus Company, which was for many years engaged in instrument manufacturing and repairing. The organization grew with the radio industry and is one of the two oldest firms on the Pacific Coast in this field. Products of the present company include an automatic antenna reel, aircraft microphone, transmission line, transmitting tubes, generators, power plants and other aircraft radio equipment. Heintz and Kaufman equipment has been used on the Byrd and Wilkins expeditions, Kingsford-Smith's "Southern Cross" and on the ill fated "Dallas Spirit" at the time of the Dole flight. Besides Messrs. Heintz and Kaufman, executive personnel includes Philip Scofield and Carl Odell. The plant is at South San Francisco.

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SOLAR AIRCRAFT, LTD.

SPECIALTY manufacturing in stainless steel and duralumin is the job of Solar Aircraft Company, Ltd. In 1928 the directorate control was assumed by Edmund T. Price, president, who is active head of the business at the present time.

Principal product of Solar is an engine exhaust manifold, specially designed to fit into various installations of engines and cowlings. The long list of aircraft using these manifolds includes Sikorsky, Martin,

Edmund T. Price, president.

Vought, Douglas, Lockheed, Boeing, Fairchild, Northrop, Consolidated, Curtiss-Wright and many others. Other specialty products include fuel tanks, oil tanks, heaters, and similar devices.

At the end of 1935 there were three officers and 67 employees. The company turned out an average of more than two manifolds per day during the year. The present factory is on Lindbergh Field, San Diego.

BOEING SCHOOL OF AERONAUTICS

OPERATED as a division of United Aircraft and Transport Corporation, the Boeing School was organized more than seven years ago. In the period 1933 to 1935, 85 per cent of its graduates found employment in aeronautical and allied fields.

The school premises occupy 45,000 sq. ft. of floor space in hangars 4B and 5 at Oakland Airport. Eleven airplanes of capacities ranging from two to fourteen persons are operated exclusively for student

Left to right: T. Lee, Jr., manager, A. F. Bonnalie (ground training); George I. Myers (flying).

instruction. Courses include training for positions as pilots, engine and airplane mechanics, metal workers, instrument men, dispatchers, radio operators, and traffic men. The availability of the United Air Lines operating base and of federal radio and weather stations on the airport is a valuable aid to student training.

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CURTISS-WRIGHT TECHNICAL INSTITUTE

THE Curtiss-Wright Technical Institute of Aeronautics is one of the important units of Aircraft Industries, operating organization for the Grand Central Air Terminal at Glendale. It was founded in 1929 by Major C. C. Moseley, under the direction of the Curtiss-Wright Corporation and was taken over by Aircraft Industries two years ago.

Courses are offered in mechanic's training, including airplane and engine maintenance, aeronautical

Left to right: O. D. McKenzie (registrar), E. M. Chase (secretary and treasurer), Lewis Haines, Carleton E. Stryker, C. C. Moseley (presiding and general manager), Charles Kidder (service manager).

engineering, and other related subjects. Flying instruction is available at the Grand Central Flying School operated by J. B. Plosser.

The State Department of Education has approved the curricula for Junior College Standing.

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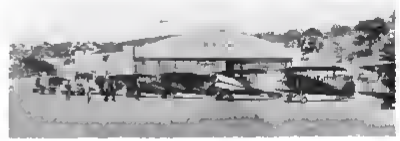
RYAN SCHOOL OF AERONAUTICS

Earl Prudden, vice president.

THE origin of the Ryan School of Aeronautics antedates the establishment of Ryan Air Lines (see page 18). In 1932 the school constructed its present facilities—the administration building, housing general offices, class rooms, and airplane display room; and the hangar where mechanical work is taught.

Courses at the Ryan School fall broadly into the general divisions of flight and technical training. In the flight division particular attention is given to the acquisition of cross-country skill by conducting overnight group flights for advanced students under the personal direction of an instructor. Two elective courses for radiotelephone and radiotelegraph operators' licenses are offered. Technical courses include practical and theoretical training in aircraft construction and repair, engine overhaul, instrument construction and maintenance, radio, navigation, and meterology.



AIR ASSOCIATES

Ted Lynn
Western division manager

ORGANIZED in New York in 1927, Air Associates now act as national selling agents for many prominent manufacturers of aviation equipment While the company is primarily a sales organization, it maintains an engineering staff and manufactures many aviation products at its eastern headquarters Present policy is to operate branches as separate units

During the little more than two years of its existence, the Western branch has grown to the point where its sales are soon expected to exceed those of any other unit of the company Management of the Western division is under Ted Lynn, formerly of the Chicago branch Sam Breder is in charge of sales to manufacturers.

The organization is housed in 6,000 sq ft of the main building on Grand Central Air Terminal Recently a mezzanine floor was erected which increased available floor space approximately 40 per cent

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NICHOLAS-BEAZLEY AIRPLANE COMPANY, INC.

TO ACT as distributors of war surplus equipment, Howard Beazley and Russell Nicholas organized the Nicholas-Beazley Airplane Company in 1923, at Marshall Mo It was incorporated in 1926 and since then has operated as an aeronautical supply house. As war surplus materials became scarce, they were replaced by supplies in current demand

First expansive move was made in August 1929

Russell Nicholas

Howard Beazley

when the Western branch was established at Glendale Looking eastward toward national coverage, another branch was opened at Floyd Bennett Field New York in January 1932. In October, 1935 a Southern division was established at Love Field, Dallas

Several years ago the company sponsored the design and production of a low-wing monoplane

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PACIFIC AIRMOTIVE CORPORATION, LTD.

A REPAIR service for airplanes and parts, as well as for four different engines plus a supply service covering many brands of engines and parts, constitutes the set-up of Pacific Airmotive Corporation, Ltd., at United Airport, Burbank The business was started in West Los Angeles, in 1927. Two years later it was reorganized under its present name and in 1931 it took over the present 36,000 sq ft of space at Burbank Palmer Nicholls is president

As the third and last of a series of articles telling of what he saw on a recent visit abroad, the author discusses the function of research in the building of

New Wings for a New Germany

By Edmund T. Allen
Consulting Aeronautical Engineer

WE have already described in some detail (AVIATION, December, 1935) how the Germans are solving their first problem of stopping the gaps in their defense structure and again fitting themselves into that group of nations whose defensive armaments enable them to be heard across the bargaining-board of world politics. The major portion of their program, however—and the one which seems wholly to have escaped the notice of a public determined to find something morally reprehensible in someone else's armament—has a more far-reaching import. It has nothing at all to do with the hurried production of aircraft of second rate performance to make some sort of equipment available to meet immediate needs for defense. It looks, rather, into the future, toward an economic state in which air-borne commerce is a fundamental factor in the production and distribution of goods. It concerns itself with fundamental research in speed, economy, safety, and comfort. As a super-committee in control of air development, the Vereinigung für Luftfahrtforschung functions effectively as a clearing house, orientating research and promoting commercial air expansion It fuses all the related activities of the country into a concerted effort toward a common goal

In planning such a far-sighted policy Germany had one great advantage in starting practically from scratch. In a country no longer committed to democratic principles there were no difficulties presented by political opposition, no modifications imposed by parliamentary deliberation nor any vested interests in powerful bureaus to offer resistance Most significant factor in the aeronautical program thus inaugurated was the enormous size of the research budget. Cost was no item The aeronautical scientist was free to plan full-scale wind tunnels, giant engine laboratories, fuel research factories, and laboratories for chemical and physical research practically ad lib

The primary motive in aircraft development is, after all, industry and commerce rather than war. Although at the moment the production of bombers seems to hold first place, Germany is also perfecting her air-freight carriers, and the Graf Zeppelin has quietly completed its hundredth crossing of the South Atlantic with goods and passengers for South America German airplanes with German pilots profitably carry passengers and goods at low rates between Rio de Janeiro and Santiago de Chile. A steady stream of German commercial airplanes is being marketed in the Far East, effectively reopening channels of commerce once served by the ancient trade routes So Germany endeavors to compete with the other peoples of the world, with other systems of political economy. To insure success, aerodynamic research is of vital concern

From its inception, the program naturally made use of existing university laboratories and the Deutsche Versuchsanstalt für Luftfahrt (corresponding to our NACA at Langley Field) which was suddenly expanded tenfold in size and scope, and which has probably contributed little or nothing to the present military expansion It is looking far into the future with its laboratories set up for monocoque structural research, its projects for approaching the ultimate in low drag and light weight, its basic approach to questions of best arrangement in high-, low-, mid- or gull-wing designs In addition, it is working on problems of engine design and development, pitting the Diesel against fuel injection, and both against the normal engine operating with high octane fuel

DVL and NACA

Its history parallels in some respects our NACA, though there were certain characteristic differences Both were infants in 1920 The NACA was a modest organization with a small laboratory, one test pilot, a couple of "Jennies" full of test instruments Like a poor relative, it was permitted to occupy an obscure corner of an Army Field. Its research problems were completed in spite of, rather than with the cooperation of the industry. The DVL of that day was likewise on the defensive, a tiny group of bespectacled scientists wrestling with problems which Dr Dornier in his great aircraft factory on the Bodensee considered beneath his

contempt How could an integral sign help an airplane fly? The enthusiastic researchers thought they knew the answer to that one, but they never knew from month to month when their meagre salaries would be stopped—their vital research problems cut off short of solution.

Theory vs. practice

For a long time there was a feeling that the demarcation between the theoretical and practical was not to be transcended—that only the flier could know when an airplane is right The scientist, although he might know all about the equations for flight, was supposed to be incapable of acquiring much skill in flying There are always individuals whose breadth of vision does not quite take in indirect methods of approach to problems They prefer the cut-and-try methods, which in aviation, at least, seem to have the sanction of the inevitable It is a fact that many experimental airplanes (some as late as the 1935 races) have been built successfully by practical people burdened with very little aerodynamics.

The problem of dealing with these two elements has been faced through the years of aviation's infancy Opposed to the philosophy of Dr. Dornier was Dr Junkers who, as far back as 1920 went to Gottingen and to the DVL for information, testing, and advice. For him there was never any question of the ultimate answer to the biplane-monoplane controversy. He built cantilever monoplanes in the light of Prandtl's theory of induced drag while most other builders looked on with open skepticism When Dr Junkers died, bankrupt, there were undoubtedly those who were ready to remark, "I told you so" Now, however, the Junkers factory is the largest aircraft factory in the world, a monument to the worth of the practical application of research methods

The big DVL wind tunnel at Adlershof can handle model spans up to 12 ft. The slotted entrance cone is intended to improve boundary layer control.

In the laboratories

The university aerodynamic laboratories at Göttingen, Hannover, Aachen, Stuttgart, and Berlin are being used effectively in the new program. Envisaging the significant value to student designers of contact with practical problems during their university work, the VLF steering committee has designated each university laboratory as a testing station for some particular set of problems Gottingen with its magnificent wind tunnels and aerodynamic facilities, was chosen to test Junkers designs. Some twenty-odd Junkers project engineers are there all the time to oversee the tests Probably Dr Prandtl looks sadly on the interruption of his pure research, although he may find some compensation in having been made Committee Chairman on aerodynamics for the VLF. Aachen University aerodynamics laboratory has been turned over to Heinkel tests Wind tunnel models are arriving there from Rostock, I am told, at the rate of one a day

The big DVL tunnels at Berlin-Adlershof are rarely used for design-testing and model development as this is regarded as applied rather than basic research They are assigned the more fundamental problems. The large tunnel is 17 by 23 ft at its throat, capable of testing a model 12 ft in span at 150 m.p.h., with correspondingly small VL correction It is of the open throat type, with a slotted entrance cone, an arrangement claimed to give the most satisfactory boundary layer flow. The tunnel is constructed of reinforced concrete, plastered on the inside and waxed. It is said to be quite dustless, although I noted that the large wooden corner-vanes were oiled and used apparently as dust-collectors. The flow is remarkably free from turbulence, owing partially to the design of the honeycomb far back of the necking of the throat exit. The automatic balances are ingeniously mounted on a central spindle directly over the throat. They indicate forces and moments in coefficient form, and, at the pressing of a button, they automatically record and plot their value on a chart fed through the recorder. When it is remembered how many months are often required to do a test and work up the results and computations by old-fashioned methods, the great value of this type of recording in speeding up all testing is apparent

The DVL tunnel for the study of freely spinning airplane models is housed in a building that looks like a huge pear Contrary to the assumption of Mr. Grey of *The Aeroplane*, this shape was not chosen primarily for the purpose of streamlining the flow in the return passage of the tunnel, but rather for the purpose of permitting the tunnel to be operated under a pressure of two atmospheres. Such operation makes possible the use of normally weighted models with results comparable to flight tests at full-scale.

Inside the pear-shaped building (which one enters through the pressure-door at the end of the outside stairway) is an observation platform around the open vertical throat of the spinning chamber The propeller and driving motor are in the top of the building, with a screen to keep the models from being sucked up into the blades. Below, in the cavernous throat (approximately 15 ft. across), is a cloth netting to catch the models when they recover from the spin and go into a dive A proper gradation of velocity across the diameter keeps the models in the center, and adjustment of the speed of the airstream to the rate of descent of the model keeps it at the best height to observe its behavior. The open throat is peculiar to this tunnel. It permits the observers to watch closely the action of the model when the controls are moved for recovery The spins are photographed with a high speed motion picture camera. From the photographs, angles of yaw and sideslip, and rates of rotation and descent can be determined and corrected to full-scale. It is by these methods that confirmation has been obtained of such phenomena as the delayed recovery caused by pushing forward on the stick. Many pilots are still unaware of the fact that uncontrollable, and often fatal spinning is aided by the very move they have believed will get them out—stick-forward!

This strange looking building at Adlershof houses a vertical wind tunnel in which the behavior of freely spinning airplane models may be observed It is built to operate at pressures up to two atmospheres.

Flight tests

The flight testing section of the DVL is engaged in problems of determining the degree of coordination between wind tunnel results and free flight. It also does all manner of tests of new devices, developing them for the airlines and for the Services. A branch of their work includes performance testing of new airplanes for the Air Ministry Occasionally such testing is done at the DVL private flying field at Adlershof, but usually it is done at the designer's factory. Complete flight testing of this kind includes (besides tests of speed, climb and takeoff) the quantitative measurement of all flying qualities such as stability, controllability and stalling characteristics. This new branch of DVL activities is particularly interesting to Americans who are now trying to measure the subtler flying characteristics usually left to the test pilot's opinion

One of the most interesting features of the flight test branch of the DVL is the School for Test Pilots, where an attempt is being made to bridge the gap between theory and practice—between the highly skilled test pilot with his invaluable background of instinctive judgment, and the engineer who is thoroughly conversant with theoretical terminology and the manipulation of the differential equations of flight. Here "diploma engineers" and doctors of engineering are inducted into the higher mysteries of the falling leaf, fishtail landings, and the inverted spin

It is interesting to note that all the members of the brilliant 1922 graduating class of Hannover in aeronautical engineering are now famous in German aviation In 1921 they formed a society for the circumvention of the intended extinction of German flying by building airplanes without motors. The record-breaking sailplanes "Vampyr" and "Grief" were designed, built, and flown by them, probably the first aircraft to be conceived as the solution of an equation of minimum sinking speed.

Beyond all doubt the present outburst of aeronautical enthusiasm in Germany is a direct result of the repressions imposed by the Treaty of Versailles. Our own economic, political and geographic circumstances have been vastly different The pressure that has forced the growth of Germany's aviation has not been felt over here, but it is not impossible that the exigencies of a rapidly changing world economy will force all elements of our aeronautical industry into fuller and closer cooperation to meet the competition of foreign nations in both the civil and military categories.

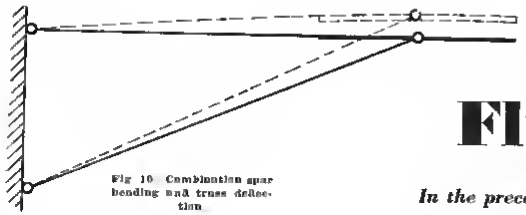


Fig 10: Combination spar bending and truss deflection

Flutter

In the preceding article the author discussed the general characteristics of the several types of flutter. In this installment he treats the causes and cures for flutter of cantilever wings, tail surfaces, and servo controls.

By Manfred Rauscher
Assistant Professor of Aerodynamics
Massachusetts Institute of Technology

ON A WING or tail with external bracing (as pointed out in Part I, AVIATION, January, 1936) flutter is constrained between nodes at the points of support. Whether these points may actually be regarded as fixed, and therefore as true nodes, or whether they are capable of substantial movements of their own, depends on the type of bracing, especially on whether struts or wires are used.

When the bracing is *not rigid*, a movement of the wing structure as an elastic truss is superimposed on the motions possible under rigid bracing. This movement is roughly equivalent to a shifting of the effective node inward from the bracing point. The greater the truss deflections become in comparison with the bending deflections of the spars, the more nearly the motions of the wing panels approach straight rotations about the inner spar hinges, and the farther inboard, therefore, the effective nodes move. The yielding of the outer supports thus causes merely an increase in the effective overhang of the wings. The exact location of the effective nodes is difficult to determine, but as a simple and not seriously inaccurate rule, the nodes may be assumed to lie at the inner spar hinges on wings with normal overhang (say, 40-60 per cent of the bay length). When the overhang is unusually small, the bending of the spars under the truss accelerations may contribute materially to the motion of the outer portions of the wings. The motion of the aileron hinges then becomes more nearly straight up and down (Fig. 10), and the inertia loads on the ailerons correspond approximately to a node at infinity. But wherever the effective nodes may lie, flutter about them can be prevented by a proper balancing of the ailerons and the provision of adequate torsional stiffness in the wing panels.

The yielding of the supports generally involves also a *twisting* of the wing panels (Fig. 11), but under ordinary circumstances the effect is small enough to be neglected. Where it may become important is on wire-braced monoplanes with abnormally poor bracing angles and also, to a lesser extent, on biplanes with crossed lift wires, or with a single anti-lift truss in combination with a standard lift truss. (Sweepback calls perhaps for less caution on externally braced wings than on cantilevers.)

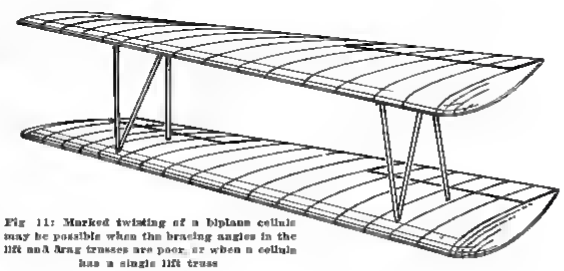


Fig 11: Marked twisting of a biplane cellule may be possible when the bracing angles in the lift and drag trusses are poor, or when a cellule has a single lift truss

Thus, when the bracing does not support the wings with extreme firmness in torsion, a distinct overbalance of the ailerons, as recommended on cantilever wings, is desirable.

Inter-aileron linkage

Links between the ailerons of the upper and lower wings of a biplane merely change the effective balance of the ailerons, as long as the wings are equal and are fluttering in phase. If, however, the wings deflect in opposite directions, the inter-aileron links move the ailerons in opposite directions also, and in a sense that may produce air loads tending to increase the deflection further (Fig. 12). The danger here is not one of vibratory instability, but of a straight *divergence* from the equilibrium position. In view of the rather low rigidity of the individual panels in a biplane cellule, the possibility of such a divergence may exist at relatively low airspeeds. To eliminate the hazard, it is advisable to place the inter-aileron links in the plane of the inter-plane bracing where they will not be disturbed by any deflections of the wings, —or else on that side of the bracing point on which the smaller portions of the ailerons lie, where the effect will be predominantly beneficial. In the latter case, the mass of the struts will, incidentally, contribute to the effective mass balance of the ailerons.

The flutter of tail surfaces is essentially like that of wings. In the case of *symmetrical* flutter, the similarity is complete, and no special discussion appears necessary. The cure lies in mass balancing the elevators, and in providing adequate torsional stiffness in the stabilizer.

Anti-symmetrical flutter of the horizontal surfaces corresponds closely to anti-symmetrical wing flutter, and so

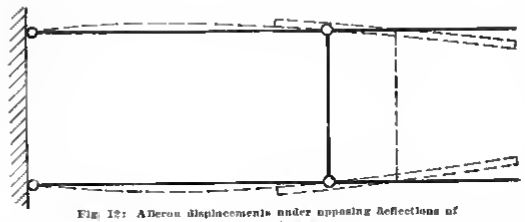


Fig 12: Aileron displacements under opposing deflections of biplane wings

does flutter of the rudder and fin (Fig. 13). Additional points to be considered, however, are (*a*) the influence of the torsional elasticity of the fuselage on the effective flexural stiffness of the fluttering surfaces, and (*b*) the possibility of joining the elevators by a stiff torque tube, with the same effect as if they were clamped to the stabilizer at their roots. If the elevators are thus connected, the principal danger of flutter remains in the fin and rudder. Balancing the rudder is then the next step—and one of considerable importance. For a *complete* elimination of anti-symmetrical flutter, mass balancing of the elevators is, finally, indispensable, since the clamping provided by an interconnection of the two halves is fully effective only at the inner ends of the surfaces.

A servo flap is to the surface it operates as an aileron would be to a wing swiveling about a fixed axis at the leading edge. In this case, however, the axis will itself be set in motion as the flutter gets under way, but that will not alter the general nature of the problem. The essential thing is that an angular acceleration of the main control surface about its hinges should not cause the auxiliary surface to deflect in a direction favoring a building up of the motion. This means that the servo tab should be mass balanced for all possible motions of its hinge line—or, better yet, over-balanced.

Aerodynamic balancing, damping

The participation of the control surfaces in flutter has so far been ascribed solely to their inertial unbalance. That aerodynamic forces also may affect the motion of these surfaces is, however, apparent, and any complete discussion of flutter must take these forces into account.

Consider first the effect of a straight transverse motion of a wing on the ailerons. If the motion were steady and the controls free, the ailerons would align themselves so as to make the moments about their hinge lines zero, i.e., they would deflect through an angle β roughly proportional to w/U, the ratio between the transverse velocity and the forward velocity, which represents the change in the effective angle of attack of the surface in its original shape. The aerodynamic force due to a given deflection β varies as U^2, other things being equal. Hence, the deflection of the aileron produces a negative damping proportional to U, and thus annuls part of the damping on the wing as a whole, which also increases linearly with U. An exactly parallel growth of the negative and the positive damping effects may not always be expected in the wing and aileron motions actually involved in flutter, but it seems improbable that the relation between these effects should be fundamentally different. The aileron lag produced by aerodynamic forces is then never sufficient to make flutter unstable, and flutter can develop only as a result of other upsetting effects. Similar conclusions hold, of course, with regard to aerodynamic elevator and rudder lag.

While the mass balance of the movable surfaces thus remains the controlling factor in flutter, it is to be noted that the aerodynamic balance of these surfaces may have an effect on flutter if mass balance is not provided. Flutter always sets in when upsetting effects outgrow stabilizing effects, as shown in Fig. 14. Since the aerodynamic aileron lag reduces the effective damping of the motion, it might seem that the critical speed could be raised by decreasing that lag, i.e., by balancing the ailerons aerodynamically. Actually, however, aerodynamic unbalance has a beneficial as well as a detrimental effect, it tends to align the ailerons in the manner described, and it assists in keeping them from deflecting too violently under the effects of their inertial unbalance. In fact, the lighter the ailerons can be made, the closer will they be held to the positions corresponding to straight aerodynamic lag, i.e., to movements unable to sustain flutter. Generally, then, aerodynamic unbalance, rather than balance, would appear to be advantageous. That a close approach to aero-

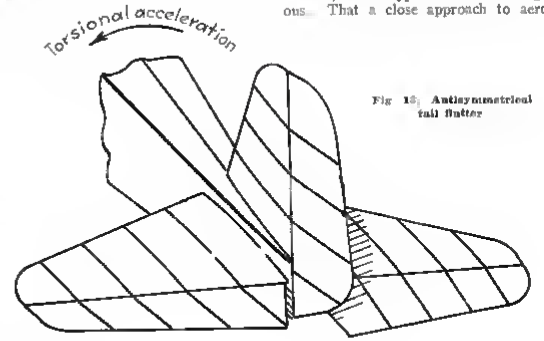


Fig 13: Antisymmetrical tail flutter

dynamic balance does become beneficial in the presence of mass overbalance seems, however, certain. Since the aileron movements caused by the mass overbalance are beneficial, the least possible aerodynamic restraint should be placed on them.

It is probable that a pronounced aerodynamic effect also arises from the transverse and torsional *accelerations* of a wing, but concrete data on this point are still lacking. Until they become available, it may merely be suspected that the effect will add to the apparent unbalance of the movable surfaces. This suggests one more reason for a mass overbalance of these surfaces.

Resonance, non-regular flutter

While flutter, in the proper sense of the word, is a self-induced oscillation of an aerodynamic surface, vibrations more or less similar to flutter are sometimes produced by outside influences, such as the shaking of engines, the unsteadiness of the flow near a propeller, or the impulse alternations of eddies shed by the wings. Flutter of a peculiar kind may also arise near the stall of a wing, from causes similar to those of autorotation. Finally, there is the chance of a straight diverging motion, or non-oscillatory instability, of a wing or tail under its air load.

In the vibrations caused by pulsating

disturbances from without, the building up of a dangerous amplitude depends largely on resonance "Flutter" of this kind will thus develop only when an elastic system is exposed to periodic impulses whose frequency is close to one of the natural frequencies of the system, and only if the oscillation at that frequency involves inertia effects compared with which the damping effects are small.

The particular importance of the damping is shown clearly in the oscillations of wings and tails under the shaking of the engine. Such oscillations are often noticed on the ground, where the still air offers relatively little opposition to their building up. But they always subside as the air speed (and with it the damping) increases. The subsidence is most rapid in the case of vibrations in the surfaces' basic modes, or modes of lowest frequency, which are the modes corresponding to ordinary flutter. Higher mode oscillations tend to survive longer, because the inertia effects grow with the square of the frequency, while the damping effects increase only with the first power of the frequency. Even though oscillations of this type may actually be possible, especially if aided by unbalanced ailerons, their seriousness has not been established. Balancing of the ailerons and very soft cushioning of the engines seem to remove whatever danger there might be.

The general incapability of wings and tail surfaces to sustain resonance still leaves a possibility of resonant oscillations of the fuselage relative to the wings. The tail enters into the vibrations as a part of the fuselage, its damping being ineffective on account of the large masses involved in the motion. Fuselage-tail vibrations of this sort may sometimes be subdued effectively by stiffening the connection between the fuselage and the wing—e.g., by using struts instead of wires in the transverse bracing of the center section on a biplane or externally braced monoplane. Any measure of this sort, however, should be supplemented by a proper cushioning of the engine on its bearers.

Flutter of a resonant type might conceivably be produced also by the rushing of propeller blades past a wing or tail. But there appears to be little actual danger—except perhaps on the tail of a pusher airplane, if the torsional frequency of the tail is close to the frequency of the slipstream impulses.

Eddy disturbances

One of the primary causes of flutter has sometimes been seen in the pulsating reactions to which a body is subjected by the eddies drifting away in its wake. On the presumption that these disturbances had some predominating frequency depending on airspeed, flutter was thought to develop as a resonant response of the wing at some critical speed. As a matter of fact, the wake pulsations are known to be quite irregular at small angles of attack, and to become fairly regular only around the stall. (W. J. Duncan, "Tail Buffeting." Lecture before the R.Ae.S., Nov. 30, 1933.) Since flutter is generally met at high speeds at angles near zero lift, the weakness of the resonance hypothesis is apparent. It is thus hardly necessary to enumerate other reasons why such a theory appears untenable; but the most important are:

1. Flutter does not occur at a single airspeed or over a narrow range of speeds but increases rapidly and indefinitely in violence as the airspeed is pushed higher and higher beyond the critical speed.

2. Resonance presupposes a higher ratio of mass forces to damping forces than is normally found on a wing—unless self-induced flutter happens to be already imminent.

This, of course, does not rule out the possibility that the wake pulsations could actually contribute to the instability of flutter in an isolated case, especially at a high angle of attack. Nor does it mean that the circulation changes corresponding to the departing eddies might not be great enough to jerk the wing back and forth perceptibly. The only thing claimed is that these effects, while interwoven with flutter, are not the cause of the violent instabilities that constitute the real menace of flutter.

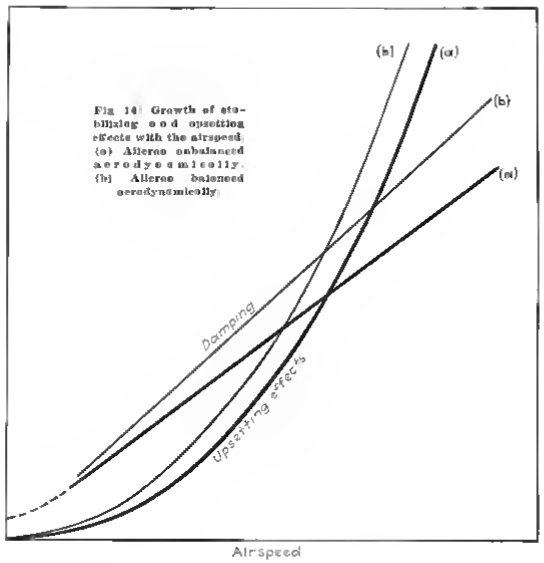


Fig. 14: Growth of stabilizing and upsetting effects with the airspeed. (a) Aileron unbalanced aerodynamically. (b) Aileron balanced aerodynamically.

Buffeting

A distinct danger from the pulsations in the wake of a wing does exist in the possibility of their impact on tail surfaces. What has been said with regard to excessive damping, etc., obviously becomes meaningless when the whole flow about a vibrating surface is itself oscillatory and thus provides upsetting as well as damping effects. The damping effects are, however, bound to predominate if the amplitude of the vibration becomes larger than that of the wake undulations. Even this amplitude can be maintained only if there is resonance between the eddy frequency and one of the basic natural frequencies of the tail surfaces,—the frequencies particularly involved being those flexural vibrations of the horizontal surfaces relative to the fuselage, and of torsional oscillations of the tail unit about the fuselage axis. Since the bumpiness of the wake is fairly regular only when the wing is stalled or near the stall, it is only then that there is any actual danger of resonance. But even without resonance, *buffeting*, as this type of shaking is called, may be sufficiently severe to endanger the structure or to inconvenience the pilot.

The only complete cure for buffeting is the removal of the tail surfaces from the wake of the wing. If the horizontal surfaces can be kept outside the wake at high angles of attack, but fall within it at low angles, a satisfactory remedy is found in filleting the wing roots, which helps to keep the flow near the fuselage from breaking away before the wing actually burbles. Experience shows that a placing of the tail *above* the wake at the stall is quite impracticable, and that keeping the tail below the wake, while easy on a high-wing machine, generally means putting the horizontal surfaces near the bottom of the fuselage on a low-wing type—even that being often not low enough. Since, however, the angle of downwash does not increase as rapidly as the angle of attack, the tail can be lowered relative to the wake at the stall by a raising of the stalling angle, e.g., by the use of a leading edge slot extending over the portion of the wing upstream from the tail. At the original stalling angle the wake then remains smooth, and at the new stalling angle the wake is likely to lie above the tail.

That buffeting may still occur in a sideslip when it has been eliminated for straight flight is due partly to the breaking up of the flow on the leeward side of the fuselage, partly to the changed flow pattern about the leading outer wing, and partly perhaps also to a shaking of the portion of the vertical tail which sticks up deep into the wake.

A possible half-way remedy for buffeting would seem to be in a "diffusing," or breaking up of the irregularities of the wake. On a wing equipped with split trailing edge flaps for instance, slits in the flaps (Fig. 15) might be used to make the wake eddies smaller and more numerous—perhaps without undue sacrifice of lift and drag. The alternative to smoothing the wake, or getting the tail outside of the wake, is stiffening of the tail until its basic natural frequencies are well above the eddy frequency at the stall—for which the rough value $\nu = 0.8\ U/c$ cycles per second has been found, (W. J. Duncan, in reference cited before), with U the airspeed in ft./sec. and c the wing chord in feet.

Closely related to buffeting are the vibrations caused by a flapping back and forth of the elevators—and, perhaps to a lesser extent, of the ailerons—under the pulsations of the wing wake. On the tail, where they are potentially very serious, these vibrations can be cured by smoothing the air flow, just as for straight buffeting. On the ailerons, both the need and the possibility of any curative action are still unknown. In principle, of course, clamping of the movable surfaces remains as a possible remedy in all cases.

Of the two self-induced, but non-regular, types of flutter mentioned early in this section, the first has but an indefinite actual significance. It would arise beyond the stall, where an upward velocity of the wing increases the upward force, and a downward velocity reduces the upward force, with an effect of negative damping through the whole cycle. This effect may be partially responsible for the falling of the critical speed with increasing angle of attack, as generally observed in tunnel tests. The fact that high angle flutter tends to be largely torsional indicates, however, that the effect of the burbling on the lift and the damping in flexure is not as important as the effect on the aerodynamic moment and torsional damping. But neither effect can be assessed with any accuracy, because the stalling of a fluttering wing is rather different from that of a stationary one.

A straight divergence in a biplane cellule, involving a displacement of the ailerons, has already been discussed in the section on braced wings. More generally, a divergence arises on any wing if a slight torsional deformation of the wing causes an aerodynamic upsetting moment that is greater than the elastic restoring moment produced by the deformation. The deformation will then increase until the wing fails, or until equilibrium is finally reached in some position beyond the angle of maximum aerodynamic moment. Around that angle, there exists a possibility for another freak type of flutter—consisting in a rapid distortion of the wing under the unstable air loads, in its overshooting the position of equilibrium, its snapping back past that position, etc. (Blenk and Liebers, "Schwingungen von Tragflügeln," *ZFM*, Dec. 14, 1925). But the motion is of little practical importance compared to the divergence itself, which it presupposes and in which the real danger lies.

To determine whether a divergence actually threatens is a problem in ordinary structures and aerodynamics. Assuming the airplane to be flying at the highest speed it is expected to reach, and starting with wing loads corresponding to undeformed wings, the deflections produced by these loads are figured. This permits, next, a calculation of the changes in the air loads, which then, in turn, affect the deflections, etc. If the wing is stable, the successive deflections become smaller, otherwise they increase.

A similar calculation should be made to ascertain the effectiveness of the ailerons at the highest speeds contemplated—i.e., to show that the twisting of the wing under a displacement of the aileron at those speeds is not great enough to annul or reverse the intended effect of the control movement. This test of torsional stiffness will often be found more severe than the one for a divergence of the whole wing—especially when the elastic axis is close to the aerodynamic center of a wing whose C.P. travel is small.

As far as regular flutter is concerned, any excess of torsional stiffness beyond what may be required to avoid a divergence is practically useless so long as the ailerons are left unbalanced. With the ailerons balanced, any gain in torsional rigidity is definitely to the good.

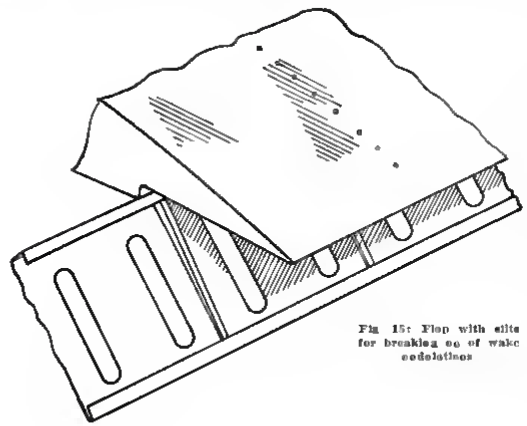


Fig. 15: Flap with slits for breaking up of wake undulations.

Professor Rauscher will continue his discussion of Flutter in an early issue.

Protection of Aluminum Alloys

Ten years of research in field and laboratory have developed satisfactory methods for protecting aluminum alloy aircraft structures against corrosion. Beyond its practical value to designers and users of aircraft, this paper is of interest in that its publication coincides with the fiftieth anniversary of the discovery by Charles M. Hall of the electrolytic reduction process which made possible the development of aluminum alloys.

By F. C. Pyne and W. L. Fink

Aluminum Company of America

The test station at Point Judith (fig 1) is used to check the corrosion resistance of various aluminum alloys and protective coatings under typical salt air conditions

At bottom: The test racks at Point Judith

THE principal factors determining the resistance to corrosion of aluminum alloy structures are composition and temper of the alloys, details of design, and condition of service. The first factor has been the subject of numerous corrosion tests, both accelerated and atmospheric, to evaluate the resistance to corrosion of most of the standard aluminum alloys.

The most reliable tests are atmospheric corrosion tests in various locations. Tests have been run at a large number of stations by the American Society for Testing Materials, The Bureau of Standards, and the Aluminum Company of America. The New Kensington station is a typical industrial location. It is on the roof of a factory building adjacent to a railroad which runs along the bank of the Allegheny River. The Point Judith station, a severe sea coast location, is adjacent to the lighthouse at Point Judith, R. I. During stormy weather, salt spray is blown onto the specimens, and the salt again forms salt solution whenever the specimens are moistened by dew or fog.

The specimens are standard A.S.T.M. tension test specimens machined from 14 to 18-gage sheet. No protective coatings are applied. The specimens are placed in frames and exposed at an angle of 45 deg. to the horizontal. Tension test specimens are employed because it has been shown that losses in mechanical properties are reliable criteria of the extent of corrosion of aluminum and its alloys, whereas changes in weight or appearance are not.

Table I shows the changes in tensile properties of a few important aircraft alloys exposed at the two stations described above. In order to eliminate aging effects as far as possible, the properties of the unexposed specimens were determined from blanks tested at the same time as the exposed specimens. The value of each property was determined by averaging the results of fifteen specimens.

In appraising the resistance to corrosion of newly developed alloys, progress would be very slow if each corrosion test involved one to five years' atmospheric exposure. Fortunately accelerated laboratory tests are available which yield results comparable with atmospheric tests and have been found to place the alloys in the same relative order as to resistance to corrosion. The most rapid of the tests, introduced by the Bureau of Standards, consists in alternate immersion of the specimen in a solution of sodium chloride and hydrogen peroxide. (9 normal sodium chloride plus 3 per cent hydrogen peroxide.) The conditions of test must be carefully controlled. Care must be exercised to always use the same grade of peroxide. In tests reported in this article, the solution was made with USPX sodium chloride and Merck's superoxol, which does not contain any inhibitors. The temperature was maintained at 30 deg. C. during the test and a three-minute cycle was used, 1½ minutes in the solution and 1½ minutes in the air. Table II gives the results of tests made on the same standard alloys as shown in Table I.

Two other tests are also being used, one is an outdoor alternate immersion test in which the specimens are immersed in a 3½ per cent sea salt solution for ten minutes of each hour. The other is a salt spray test similar to that described by Army Specification No. 98-20009. These tests have also been found to rate the alloys in the same order as regards relative resistance to corrosion.

As a result of these various investigations, the principal standard aluminum aircraft alloys have been listed in groups according to decreasing resistance to corrosion as follows:

Sheet, tubing, extruded shapes, rivets, etc. (Alclad materials are normally supplied commercially in the form of sheet): Alclad 17S-T, Alclad 24S-T, 52S, 53S-O, 53S-T5, 53S-W, 52S-T, 2S-O, 2S-H, 3S-O, 3S-H, 17S-T, 24S-T.

Forgings: A51S-W, 53S-W, 53S-T, 17S-T, 27S-T, 14S-T, A51S-T.

Castings: 214, 43, 356, 220, 355, 195. The last four depend upon heat treatment. (T4 temper is the most resistant form).

Correct heat-treatment essential

The 17S-T and 24S-T materials used in the experiments described above were properly heat-treated; that is, the heat-treating temperature was carefully controlled, the specimens were properly quenched after removal from the heat-treating furnace and a rapid quench was obtained by quenching in cold water. The specimens were not aged at elevated temperatures after quenching, but were allowed to age naturally at room temperature. Had the specimens been allowed to cool in air before they were quenched, (or had they been quenched too slowly as in boiling water or in air) or aged at elevated temperatures, the resistance to corrosion would almost certainly have been impaired. The detrimental effects of improper heat-treating have been considered in detail in Report No. 490 of the National Advisory Committee for Aeronautics. Typical results are also given in Table III.

Specimens of Alclad 17S-T sheet joined together with 17S-T rivets have also been tested. Various gages of material were included and after a period of five years exposure to laboratory salt spray, no loss of strength was revealed in any of the joints. The jointed specimens were exposed without protective coatings of any kind and the properties of the joints, both before and after subjection to salt spray conditions, for the period indicated, were obtained by means of tension tests.

Many aircraft structures have been made of unprotected Alclad material, with possibly the most unusual application being the use of very thin gage Alclad 17S-T sheet (0.0095 in. thick) as the covering of the Navy Metalclad Airship ZMC-2. After five years of active service, the covering was found in excellent condition. The material may generally be used without paint protection so far as the maintenance of structural integrity is concerned.

The application of Alclad material without protective coatings in the case of seaplane floats, hulls and pontoons, has not as yet become general, but experimentation with the use of unpainted Alclad materials for this type of service is well under way.

In deciding to make use of unpainted Alclad materials, it must be borne in mind that all metals are subject to the effects of weathering. These effects will raise the question of the maintenance of satisfactory appearance in service. There are many safe cleaners for use with aluminum alloys, which will satisfactorily maintain the appearance of bare Alclad materials in service.

Assemblies

Where unpainted Alclad materials are not used, protective coatings should normally be applied. The problem of corrosion prevention in metal aircraft structures is further complicated when the question of joints, seams, faying surfaces, pockets and crevices where salt water can accumulate and lodge is taken into consideration. It may be considered axiomatic that *dry aluminum cannot corrode*.

In order to study the practical aspects of the problem of the proper protection of assemblies, a series of tests was instituted about ten years ago at the works of the Aluminum Company of America at Edgewater, N. J. On the roof of one of the factory buildings there a series of tanks was installed which could alternately be filled with water pumped from the Hudson River and drained. A series of specimens made from various aluminum alloys, protected by various methods and assembled in such fashion as to simulate as closely as possible the details of metal aircraft construction was exposed in these tanks. By the alternate filling and emptying of the tanks, a periodic wetting and drying action occurred on the specimens. The water in the Hudson River at that point was found to have a salt concentration about 50 per cent that of high sea conditions. This concentration was undoubtedly increased as a result of evaporation. Furthermore, the river was contaminated with various industrial wastes which, in combination with the salt water, produced a very severe corrosive medium.

As a result of these tests, which are still in progress, the best available protective coating systems for aluminum alloy aircraft operating under the most severe conditions have been developed. The tests, too, have demonstrated that detail anodizing and shop priming prior to assembly of each individual part must, in general, be resorted to, unless these parts are of Alclad materials.

Table II: Alternate Immersion Tests of 14 Gage Sheet

Major axis of tension test specimens perpendicular to direction of rolling (NaCl + H_2O_2 solution)

(Per Cent Change)

	48 Hours		96 Hours	
	Tensile Strength	Elongation	Tensile Strength	Elongation
Alclad 17S-T			+1	−5
2S-O			−3	−24
3S-O			−1	−32
17S-T	−15	−52		

Anodizing process

Anodizing is the production of an artificial coating of aluminum oxide on the surface of aluminum alloys by electrochemical means. It has been found that this oxide coating in itself not only affords a certain degree of protection from corrosion, but what is even more important, prepares the surface of the material to provide the best paint adherence.

There are two types of anodizing in current use; one is the chromic acid process, as described in Navy Department Process Specification SR-19c and also by Army Air Corps Process Specification 98-20005-B. The other is the sulphuric acid or "Alumilite" process. When the anodic coating formed by this latter process is "sealed" in a 5 per cent solution of potassium dichromate, the corrosion inhibitive properties of the dichromate, which is absorbed into the anodic coating, greatly improve the resistance to corrosion of the aluminum alloy so treated and thus improve paint adherence.

Although anodizing provides the best known surface preparation for maximum paint adherence, where corrosive conditions are not unusually severe chemical treatment of the surface may be resorted to with desirable results. One of the most successful treatments of this kind involves the washing of the aluminum alloy surface with a solution of phosphoric acid and alcohol. Various compounds of this nature are on the market. The main object of surface preparation for painting is to insure that the surface of the material is clean, free of grease, oil and dirt, and chemically passive.

Having obtained a clean, passive surface, the next consideration is the choice of paint. Obviously the painting system should have high resistance to moisture penetration. Furthermore, the pigment in the prime coat should be definitely corrosion inhibitive in character. For priming coats on aluminum, zinc chromate has been demonstrated by both test and practical service to be one of the best pigments. It has been found that zinc chromate primers, which meet the U. S. Naval Aircraft Factory Proposed Specification P-27, give best results.

For the top coats, aluminum paint is to be recommended. Pigment may be added in the form of paste or fine powder. In either case, the choice of vehicle is important and long oil Bakelite varnish of the type covered by U. S. Naval Aircraft Factory Proposed Specification V-10c has proved durable. The better glycerol phthalate base vehicles (such as covered by Naval Aircraft Factory Proposed Specification V-11c) have also given very satisfactory results.

Table I: Atmospheric Corrosion of 14-Gage Sheet

Major axis of tension test specimens perpendicular to direction of rolling

(Per Cent Change)

	At New Kensington, Pa.						At Point Judith, R. I.			
	One Year		Two Years		Five Years		One Year		Two Years	
	Tensile Strength	Elongation	Tensile Strength	Elongation	Tensile Strength	Elongation	Tensile Strength	Elongation	Tensile Strength	Elongation
Alclad 17S-T	+3	−2	+3	+4	−2	−4	+2	+2	+3	+2
2S-O	0	0	−1	−1	−2	−3	−2	−6	−5	−2
3S-O	−1	−3	−2	−22	−2	−5	−3	−19	0	−15
17S-T	−3	−21	−4	−21	−5	−27	−14	−67	−14	−62

Accessibility for inspection

It is important in the original design of an aircraft structure, especially one intended for operation in and about salt water, to have all parts readily accessible for inspection, cleaning and repair, and also to have the structure designed in such a way as to afford facilities for drainage of salt water from parts in which salt water may accumulate.

The use of materials which have a tendency to absorb moisture and hold it in contact with the metal portions of an aircraft structure should be avoided. If their use is unavoidable, provision should be made to moisture-proof the area of contact between them and aluminum alloys to the greatest possible extent. For example, if wood is used in connection with aluminum alloys, the metal surfaces in contact with the wood should be primed and painted as described above. The wood should also be moisture-proofed by painting with several coats of aluminum paint in long oil moisture-proof varnish vehicle, such as Bakelite. Sound-proofing and thermal insulation may also present a problem. Care should be taken to apply moisture-proof coatings to the aluminum alloy surfaces with which such materials may come in contact.

Where water-tight joints are to be made, it is important that the materials used in making these joints should be as non-hygroscopic as possible. If fabrics are used in the making of water-tight joints, the fabrics should be thoroughly impregnated with such materials as Bakelite varnish or marine glue. To make sure that all of the fibres are thoroughly impregnated with the moisture proof material, the fabric should be wrung out in the moisture-proofing medium, leaving sufficient of the moisture-proofing in the fibres so that, when the joint is drawn up, a certain amount of the moisture-proofing will exude from the joint. Fabrics, no matter how thoroughly moisture-proof, have a tendency to dry out and eventually become hygroscopic. Therefore, if water tightness in the joints can be effected without the use of fabrics more desirable results are likely to be obtained.

A joint between dissimilar metals, which may become immersed in an electrolyte, is quite likely to show electrolytic corrosion of one or the other of the two metals, the metal which is most anodic in the given electrolyte being the one which is attacked. It is desirable to avoid contact of dissimilar metals (especially copper alloys) with aluminum alloys under salt water conditions. Where dissimilar metals or alloys must be used in connection with aluminum, however, both the dissimilar metal and the adjacent faying surface of the aluminum alloy should be coated thoroughly with zinc chromate primer (such as U. S. Naval Aircraft Factory Proposed Specification P-27) prior to assembly. Additional top coatings prior to assembly would, in any event, prove beneficial. Insertion at the faying surface of a non-hygroscopic insulating material is advantageous under severe conditions.

Corrosion inhibitor

It has been found that potassium dichromate is an effective inhibitor of corrosion of aluminum alloys. Corrosion is sometimes encountered at low points along the keel of seaplane floats and hulls where bilge water has a tendency to collect. A series of small perforated cartridges filled with potassium dichromate attached along the keel on the inside of seaplane float or hull should prove beneficial. Salt water seeping in through the joints in the bottom would tend to leech out small quantities of potassium dichromate which inhibits corrosion. In washing and flushing the insides of seaplane floats and hulls or in cleaning the interior of the structure in general, the addition of potassium dichromate to the flush water used in rinsing should prove beneficial. A very mild concentration (0.5 per cent by weight) should be sufficient.

In reconditioning parts of aircraft structures, all paint, oil, grease, dirt and corrosion products must be removed thoroughly before the surface can be prepared for repainting. Paint is better removed by means of paint removers than by mechanical action. But care should be exercised to prevent paint remover from lodging in joints seams and pockets. Parts may then be cleaned with any suitable cleaner which does not chemically react with aluminum to a harmful degree. A variety of these cleaners are available and have been investigated by responsible agencies. Just prior to painting, the surface may be washed with a chemical cleaner such as one of the phosphoric acid and alcohol combinations. Final rinsing with a 5 per cent solution of potassium dichromate is quite beneficial in that it eliminates the possibility of corrosion continuing under the paint film. All parts must be thoroughly dry before the priming coat is applied. In refinishing an aircraft structure, the same primers and paints may be used as those employed on the original aircraft, provided these have given satisfactory service. The suggestions given above, as regards primers and paints, apply equally well to new or to reconditioned structures.

Table III: Effect of Method of Quenching on the Resistance to Corrosion of 17S-T Alloy

Results of tests on 14-gage (0.064 in.) sheet. Single 8x10 in. piece used for heat-treating and quenching tests. Machined tension test specimens exposed in corrosion tests.

Quenching Method			Properties Before Corrosion		Properties After Exposure to NaCl + H_2O_2 Solution for 48 hours by Alternate Immersion		Per Cent Change in Properties After Exposure to NaCl + H_2O_2 Solution for 48 hours by Alternate Immersion	
Quenching Medium	Approx. Temp. of metal When Quenched (deg. F)	Time Required for metal to cool in air to Quenching Temp (sec.)	Ultimate Strength (lb. per sq. in.)	Elongation (per cent in 2 in.)	Ultimate Strength (lb. per sq. in.)	Elongation (per cent in 2 in.)	Ultimate Strength	Elongation
Cold Water	959	1	61625	22.3	56050	13.2	−9	−41
Water at 180°F	950	1	60175	20.7	52350	12.0	−13	−42
Boiling Water	950	1	60300	21.2	47635	10.0	−21	−53
Air Blast	950	1	59825	21.2	45015	9.3	−27	−61
Cold Water	945	7	62060	22.0	49675	7.6	−20	−66
Cold Water	800	16	60425	18.7	48330	7.1	−20	−62
Cold Water	755	22	61760	21.3	44550	5.0	−28	−77

Spot welding

Although, as yet, electric resistance spot and seam welding of aluminum alloys has not reached great prominence in production, the ground work is being laid for use of this method of joining. In this connection, it should be noted that of the high-strength aluminum alloys at present available, the Alclad materials afford the most satisfactory results from the point of view of protection of the welds from the effects of corrosion. Electric resistance welded structures are not susceptible to detail anodizing and priming prior to assembly, and from the investigations conducted thus far, it appears that the most suitable means of preserving the structural integrity of such assemblies under severe corrosive conditions is a liberal use of Alclad materials. It is, of course, possible to anodize and prime after assembly, provided the structures are of such size as to permit them to be finished in the anodizing equipment available. This method, however, does not insure protection of faying surfaces. Further details in connection with this general problem are still under investigation and it is more than likely important developments will be forthcoming in the near future.

The foregoing discussion applies particularly to the protection of aircraft structures composed of thin highly stressed materials operating under the most severe salt water conditions. Naturally, for less severe conditions for aircraft, and, generally speaking, for structures of other types, less stringent measures may often be adopted. The methods of protection are relatively simple once they are understood and aircraft manufactured and maintained in accordance with these principles should be practically free from the effects of corrosion. Many aircraft, which have received far less attention than indicated here, have given a remarkably satisfactory service.

Editorials

AVIATION

On Making Haste Slowly

ONE of the first projects announced for the new Air Transport Association is the standardization of flying equipment for all airlines. After years of purchasing equipment in a highly competitive market,—a procedure that has undoubtedly cost plenty in obsoleseence due to the rapidity with which newer and better airplanes have appeared,—the lines are beginning to think about joint action in the specification and purchase of standard types.

How far the idea will go cannot yet be foreseen. It might conceivably lead to the setting up of a central engineering and test bureau, a sort of civilian Wright Field supported by contributions from member lines, where collective operating and maintenance experience could be studied and specifications written for standard types for various services. Carrying this idea through to its logical conclusion, bids in quantity would be asked for and a group order placed for a reasonably large number.

We can see many advantages in the scheme. We have been following the work of the maintenance and other sub-committees of the associated air lines for too long to doubt the benefits resulting from the pooling of certain kinds of experience. But a program for the development of standardized aircraft should be approached with some caution.

In the past, air transport has benefited considerably from the very sort of competition that the proposed plan would tend to eliminate. The appearance of an exceptionally good airplane has always furnished the impetus for the design of a better one by a rival manufacturer.

Technical advance has been very rapid in the past few years and we see nothing to indicate that design progress is going to slow down in the immediate future. Designers have always been quick to take advantage of lessons learned by their competitors and to profit by their mistakes. Were aviation in a state of technical stagnation, this form of competition might not be particularly important, but the industry is still too young,—there are still too many things to be discovered that may change present design concepts swiftly and completely,—to risk the loss of individual initiative that might follow any premature attempt to freeze design thought into too rigidly standardized patterns.

The same sort of plan has been tried out in other transport industries and the experience has not been particularly happy nor has it yielded expected results. For example, the electric railway operators put in five years of joint research, and about $1,000,000 into a standardized trolley car that nobody wanted when it was finished. A study of this experience might yield valuable suggestions.

We are, however, in favor of cooperative effort in air transport. We think that the proposed plan is well worth trying. But we do feel that here is one place where haste should be made slowly. There is little question that the cooperative specification and purchase plan may save the air lines money in the immediate future. The real question, however, is whether or not the risk of dulling the edge of design competition is worth it. A good deal will depend on the vision and the intelligence applied to the problem by the Specifications Committee.

Cut the Red Tape

MOTOR BOATING is a healthy sport. Behind it is a compact but thriving industry. If you would be the skipper of your own small ship you must acquire,—besides the boat,—a whistle, fog bell, lights, two copies of the federal "Pilot Rules," and a life preserver for everyone on board.

But suppose before the aspiring navigator could lay hands on a steering wheel he were required to pass a grueling medical examination by an elusive federal representative planted more or less permanently at a yacht club many miles away. And, worst of all, suppose he had to pay a big fee for the test. What might happen to the thriving industry and to motor boating as a sport?

We concede that it is less hazardous to the general public to have speed boats dashing about in incompetent hands than to have airplanes lopping off suburban chimneys. We would not want to advocate any slacking up of the tests to determine the ability or the physical fitness of pilots before they are licensed,—or before they go solo. But we do think that it should be possible for prospective students to get in their pre-solo time without having to go through the present complicated and expensive routine. An ordinary physical examination by a local doctor to certify to normal vision and heart action should be all that is required to start. In the hands of a competent flight instructor there is no undue risk involved. When the student is ready to solo, then he should go up for his full Department of Commerce physical examination before being permitted to take off alone. Of course, if there is any doubt about his ability to pass the final physical examination, he could take it at any time he wished, before or during his dual training, but it should be elective and not mandatory.

Flying Equipment

More About the Douglas Sleeper

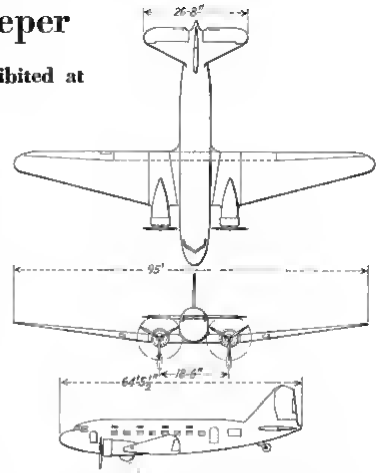
First of new 24,000 lb. transports to be exhibited at National Pacific Show

LAST month in these pages we were able to give a preliminary description of the big Douglas DST sleeper transport and of the DC-3 (its 24-passenger daytime countertype). Now following highly successful flight tests further details of the ship's performance, structure and arrangement have been released by Douglas officials. We offer them as a second instalment of our description of this ship, beyond reasonable doubt destined to play an outstanding role in the 1936 development of airline transport.

Faster and larger than the DC-2, the new sleeper transport is specially adaptable to high-speed flights of long range because of its large fuel capacity and its performance at altitude. Take-off run, take-off distance to clear obstacles and single-engine ceiling likewise are equal to or better than the DC-2.

Optional power plants are G series Wright Cyclones and Pratt & Whitney twin-row Wasps of the SBG type. The Cyclone G-5 with two-speed 7 14:1 blower gear provides 850 hp. at 2,100 r.p.m. at 4,300 ft., with 930 hp. available for take-off. With the higher altitude rating, the Cyclone G-5 with 10:1 blower gear develops 800 hp. at 2,100 r.p.m. at 11,500 ft. The Twin Wasp SBG with 850 hp. at 2,450 r.p.m. at 8,000 ft. has 950 hp. available for take-off.

The fuselage is of the monocoque type, constructed principally of Alclad 24ST and 24SRT. Although it has been enlarged and widened, the drag has not been increased above that of the DC-2, for the well rounded, streamline shape shows improved aerodynamic characteristics. The slight increase in drag of the entire airplane over the DC-2 is due entirely to the larger wing, control surfaces, tires and engines.



Higher aspect ratio and modified fuselage shape characterize DC-3 compared with DC-2

The bare interior of the Douglas Sleeper Transport

The 95 ft. wing is of Alclad cellular, multi-web construction, consisting of outer panels with detachable tips and a center panel integral with the fuselage. The center panel mounts the nacelles, retractable chassis and fuel tanks totaling 820 gal. capacity.

The DST is equipped with a landing gear embodying the best features of the DC-2 gear, but incorporating a new type oleo strut with 10-in. stroke, 4 in. greater than that on the DC-2. An additional improvement is the introduction of a linkage which transmits into the shock absorber much of the landing shock previously taken in the rear brace strut.

The hydraulic system which operates the landing gear retracting mechanism also operates the automatic pilot, braking system and flaps. It is of the constant flow type, is actuated by engine driven

pumps An auxiliary hand pump is provided for emergency operation

The hydraulically operated trailing edge flaps are of the split type, extending along the center wing panel and the outer panels to the ailerons Elevator, rudder and right aileron are provided with trimming flaps controllable in flight from the pilots' compartment

Aft of the pilots' compartment, the fuselage interior of the DC-3 dayplane differs considerably from that of the DST sleeper transport Directly behind the control compartment on the right is a combined mail and cargo compartment, while on the left, instead of a buffet, is an additional mail compartment Combined capacity of the compartments is more than 55 cu ft

In the rear of the passenger cabin are a buffet and a lavatory, behind which is a baggage compartment of 151 cu ft capacity

In the DC-3 daytime plane, accommodating 24 passengers in adjustable chairs the cabin is provided with eight rows of three seats each A wide aisle separates a single row of 24-inch-wide seats on the right from a double row of seats on the left Each of the double seats at the left is equipped with a center arm rest which may be removed to convert the double seat into a wide single seat

The first of the new 24,000-lb transports is being prepared for its first public showing at the National Pacific Aircraft and Boat Show in Los Angeles, Feb 1 to 9, following which it will be prepared for delivery to American Airlines

Artist's drawing of one of the Pullman like cabin sections

Specifications of the Douglas DST and DC-3 Transports

Wing span (ft.)			95
Wing area (sq. ft.)			987
Length (ft.)			65
Height (ft. to)			16 4
Dihedral (outer wing)			5°
Empty (lb.)			15 750
Useful load (DST)			8 250
Useful load (DC-3)			9 155
Gross weight (lb.)			24 000
Engines	G 5	G 5	SBG
Blower	7 14:1	10 1	17 9 1
Normal h hp (each)	850	800	850
R.P.M.	2,100	2,100	2,450
Critical altitude	4 300	11 500	8 000
Take-off h hp	930		950
Gear ratio	16:11	16 11	3 2
Landing speed (m.p.h.)	65	65	65
Cruising speed 10,000 ft. at 1,100 hp (m.p.h.)	184	184	181
Maximum speed at critical altitude (m.p.h.)	212	219	216
Maximum climb f.p.m. take-off	920		1 020
Service ceiling (ft.)	19 900	23 300	23 100
Absolute ceiling (ft.)	22 100	25 200	24 100
Single engine ceiling (ft.)	5 000	9,400	8 000
*Range at 10 000 ft. at 1 100 hp (miles)	1 290	1 710	1 690
*Maximum range at 10,000 ft. (miles)	2 150	2,050	2,020
Take-off distance (ft.)	1 000		940
Landing run (ft.)	950	950	950

[1]All performances except as noted with 24 000 lb. gross weight.
[2]11 500 ft. after dumping 330 gal. fuel
[3]Using maximum capacity fuel 1820 gallons)

Feederline Lockheed

New eight-place Model 12A is designed for a top speed of 231 m.p.h.

STIMULATED by a wide airline and general consumer interest and also by the Bureau of Air Commerce competition for such planes, a number of the country's leading airplane manufacturers have been at work this winter on new feeder line transports Beechcraft, Stinson, Lockheed and Kinner are known definitely to have been engaged, and we have unconfirmed reports of others In December we were able to give a few details of the plans for the new twin engined Beechcraft In this one we are able to present descriptions and specifications of the Lockheed 12, the Stinson B, and the Kinner Invader (see following). All were last month announced as nearing completion in their respective factories

The Lockheed 12 is in many fundamental respects a smaller (eight-place instead of ten-place) version of the Electra transports Its wing span will be 49 ft. 6 in., 5 ft. 6 in less than that of the Electra Its length, 36 ft. 4 in., will be 2 ft. 3 in shorter

There are to be four models of the plane Model 12A will be powered by the Pratt & Whitney Wasp Junior SB Each engine to have available for take-off 450 hp, with 300-hp available at rated rpm for cruising Model 12B will mount Wright Whirlwind engines Model R975E3 Intended primarily for sea level operation, these engines have 440 hp for take-off and 300 hp for cruising Model 12F will be equipped with seven-cylinder Wright Whirlwind engines of lower horsepower rating The fourth model, 12M, represents a marked departure from usual Electra practice It is to be powered with two Menasco six-cylinder in line engines of 290 hp each, with 195 hp each available for cruising

Although the new airplane is smaller than the Electra, the fuselage is approximately the same cross-section as the larger plane, actual length of the passenger cabin including pilots' com

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In the air there isn't a single flying condition you can encounter that these air lines haven't met. When so many of them use the same group of products it is pretty good proof that these products have qualities that you need.

You, too, will get more constant pressures, less cylinder wear, and greater freedom from carbon and stuck rings with Texaco Aviation Lubricants. You will get higher anti-knock quality and greater sustained power with Texaco Aviation Gasoline.

New refining processes have aided Texaco Engineers to produce a series of aviation lubricants that are extremely pure and notably efficient. Less carefully refined products do not have all the harmful gum and carbon forming elements removed and are not as suitable for the high performance requirements of the aviation industry.

With Texaco Lubricants you do not get hard carbon deposits. What little carbon that is formed is of a dry, fluffy nature that blows out through the exhaust ports.

See the Texaco representative who knows the characteristics of Texaco Products. He can give you sound advice on what Texaco Products will give you the best, most trouble-free service performance.

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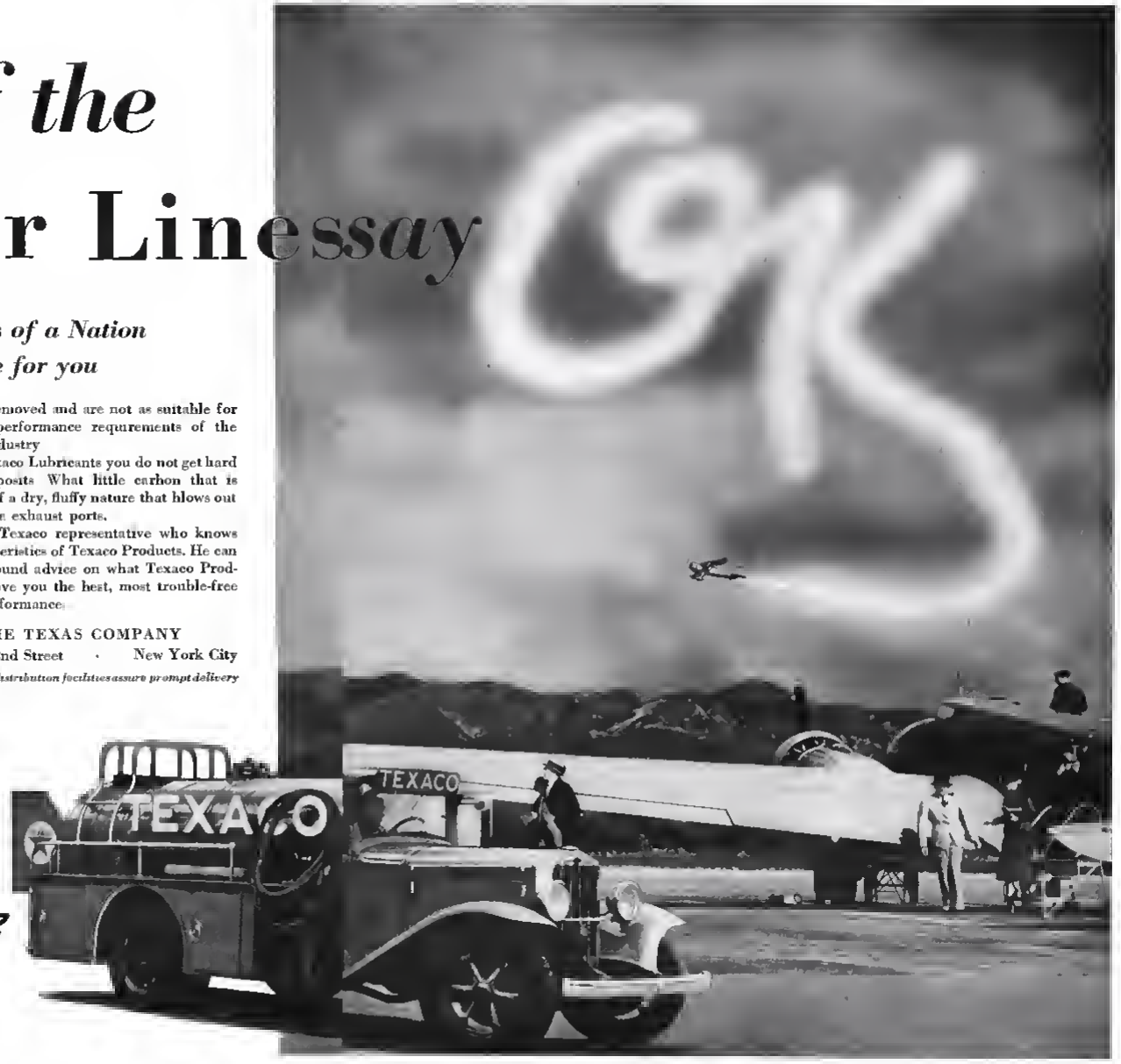
Aviation Lubricants



partment is 14 ft 8 in Maximum width of the cabin is 5 ft and total volume is 285 cu.ft. At the rear of the fuselage are lavatory facilities and a baggage compartment of 33 cu ft capacity

As in the Electra, the cabin is soundproofed and has the same system of ventilation In airline service the plane will carry six passengers in adjustable seats, a crew of two and 450 lb of cargo stored in the rear compartment and in the nose

Wing construction is of the semi-stress skin type, with a single shear beam. The wing is readily accessible and repairable Split-type trailing edge wing flaps increase gliding angle and reduce landing run

The entire wing (as are all surfaces) is made of metal The exterior surfaces are smooth with corrugations under the skin to add to the strength and to make a walkway down the center portion of the wing Wing loading is 22 5 lb per square foot

As with the Electra, the center section is cut away at the fuselage, permitting the fuselage to be placed partly within the wing This gives the airplane a small frontal area. The smooth design of the nose and forward part of the cabin reduces drag of that portion and the sloping, streamline construction also affords good visibility for the pilots

Kinner Invader

Twin engined six-eight place cabin plane to be powered with Kinner C-7 engines

Just as the new C-7 Kinner engines represent a break into new performance territory for Kinner power plants so does the new Kinner plane (which will make use of them) rank as the biggest plane yet undertaken by Kinner designers A low-winged, twin-engined six eight place cabin job, it is expected to reach 210 m.p.h. top speed at 5,000 ft., or cruise at 190 m p h at 75 per cent power at the same altitude

Its plywood-covered wing is of the one piece cantilever type with laminated spruce box spars Its fabric-covered fuselage has a chrome molybdenum tube frame to which the fin is integrally connected Tail surfaces will be of steel-tube fabric or metal covered The stabilizer will be fully cantilevered

Ailerons are of the Frise type are statically balanced and full ball-bearing mounted a tab on the left aileron permitting lateral trim. A dual, tapered split flap extends under the lower surface of the fuselage It is hydraulically operated

Streamlined landing wheels, retractable into the engine nacelles, are equipped with hydraulic brakes actuated by heel pedals The landing gear has been so designed that in event of complete failure of its operating mechanism it will lower by its own weight to a locked position It is also so arranged that moving it from full-up to full-down position shifts center of gravity only three-tenths of an inch, obviating the necessity of retrimming

The cabin is arranged to give 40 in seat spacing is soundproofed and is equipped with a heater-ventilator system, and a shelf for hand luggage At the rear are a lavatory and a baggage space large enough for two trunks and three suitcases

Dual controls are mounted on individual columns the right set being easily removable

Space has been provided for radio equipment, and the entire ship is shielded and bonded

Two supercharged seven-cylinder 370

The Lockheed 12 will be offered in four different models: the 12A with P&W Wasp SB Junior; the 12B with Wright R975E3 Whirlwind; the 12F with seven-cylinder Whirlwinds; the 12M with 300-hp six-cylinder Menasco

Specifications of Lockheed 12A with Wasp Junior SB

Type	9 PCLM
Length	34 ft 4 in
Wing Span	49 ft. 6 in
Height Overall (tail on ground)	9 ft 9 in
Wing Area (including ailerons and fuselage)	352 sq ft.
Horsepower for Cruising	300 at 2 000 r p.m.
Horsepower for Take-off	450 at 2,200 r p m
Engine Rated Altitude	5 000 ft
Take-off Run at Sea Level (with two position propeller)	780 ft
Take-off Run at Sea Level (with constant speed propeller)	600 ft
Maximum Rate of Climb at Sea Level (wheels up)	1 400 ft per min
Landing Speed at Sea Level (flaps down)	65 m p h
Fuel Consumption at Maximum Rated Cruising Power	52 gal per hr
Cruising Range with 140 gal (maximum rated cruising power)	530 mi
Fuel Consumption (approximately 66 per cent power)	39 gal per hr.
Cruising Range with 140 gal (approximately 66 per cent power)	650 mi
Service Ceiling (both engines)	24 800 ft
Absolute Ceiling (both engines)	27 000 ft
Absolute Ceiling with Full Load on One Engine	10 300 ft.
Absolute Ceiling—Half Fuel Dumped—One Engine	17 000 ft
Maximum Speed at Sea Level at 100 per cent Power	219 m p h
Maximum Speed at 5 000 ft	231 m p h
Cruising Speed at Maximum Rated Cruising Power—Sea Level	192 m p h
Cruising Speed at Maximum Rated Cruising Power—5 000 ft	201 m p h
Cruising Speed at Maximum Rated Cruising Power—10 000 ft	209 m p h
Gross Weight	7 925 lb
Empty Weight (including standard equipment and W E two-way radio)	5 355 lb
Useful Load	2,570 lb
Passengers (six)	1 020 lb.
Pilots (two)	340 lb
Cargo (mail, baggage, express, etc.)	445 lb
Maximum Oil Capacity (14 gal.)	105 lb
Normal Fuel Capacity (110 gal.)	660 lb
Maximum Fuel Capacity (140 gal.)	840 lb
Wing Loading	22.5 lb per sq ft
Power Loading	8 01 lb per hp

hp Kinner C-7 engines furnish the power. They are supported on steel tube mounts equipped with Lord anti-vibration bushings. Wing tanks have a maximum capacity of 360 gal. Propellers are of the Hamilton Standard controllable pitch type.

Specifications include: Gross weight, 8,500 lb., empty, 5,320 lb., useful load, 3,180 lb., power loading, 11.5 lb. per hp., wing loading, 21.4 lb. per sq. ft.

Estimated performance: Maximum speed (level flight, 5,000 ft.), 210 m.p.h.; landing speed (full load), 63 m.p.h.; rate of climb (full power, full load), 1,255 ft. per minute; rate of climb (one engine dead, full load), 180 ft. per minute; cruising power (75 per cent power), 555 hp.; fuel consumption (75 per cent power), 49.5 gal. per hour; cruising speed (5,000 ft. 75 per cent power), 190 m.p.h.; cruising speed (5,000 ft. 65 per cent power), 180 m.p.h.; ceiling with one engine dead (full load), 6,500 ft.; service ceiling (full load), 20,000 ft.; range (pilot, 5 passengers, 540 lb. baggage,—75 per cent power), 900 mile; range (pilot, 3 passengers, 160 lb. baggage,—75 per cent power), 1,380 miles.

The above figures are for the standard six-place ship. This ship may also be equipped as an eight-place ship, in which case the empty weight is increased approximately 100 lb., and the payloads reduced accordingly. With pilot and seven passengers, 216 gal. of gasoline, 240 lb. baggage, the eight-place ship will have a cruising range of 850 miles.

How the Kinner Invader will appear in flight

Stinson Model B

New six-passenger bimotor designed for feeder line and industrial service

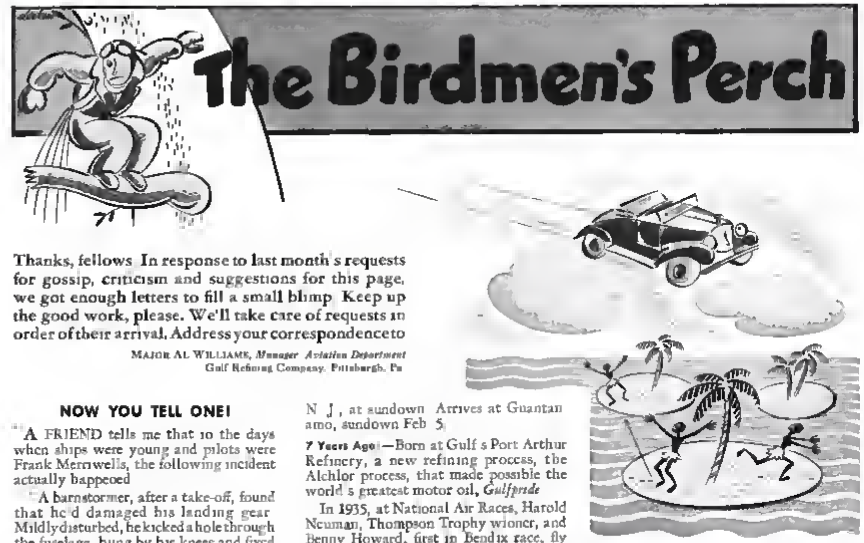
To meet a growing demand for a relatively small, economical, high speed plane for short haul and feeder service on foreign and domestic airline, the Stinson Aircraft Company has engineered and now has under construction, a scaled-down version of the Model A airliner. The new ship is of the twin-engined type with two 260-hp Lycoming engines. Except that there is no engine in the nose, the external appearance and general arrangement are very similar to the Model A. Structural details are understood to follow Model A practice also.

The basic framing of the entire plane is of metal. The propeller zones of the wings are also metal covered. Main wing panel, fuselage and tail surfaces are fabric covered. The retracting landing gear has a 13-ft. tread. It is so designed that when the wheels are in the full up position, enough of their diameter protrudes below the engine nacelles so that the plane may be landed with the wheels up without damage other than to the propeller blades.

The cabin, which is insulated against noise, heat and cold, accommodates six people. Space in the rear is available for baggage and washroom. Standard equipment is to be unusually complete, to include flares, landing lights, complete radio bonding and shielding, vacuum operated flaps, semi-retractable landing gear, controllable pitch propellers, electric starters, generator and hydraulic brakes. Standard instrument equipment will include turn-and-bank and rate-of-climb indicators, compass, altimeter, tachometer, manifold pressure gages, and oil pressure and temperature indicators.

The problem of getting in and out of small and unimproved fields has been kept well to the front in the design. Some compromise was made, therefore, in top speed to make possible slower landings and more rapid take-off, also to improve single engine performance. For this reason wing loading has been kept below the averages now common on American transports. Simplicity in design and the elimination of complicated parts have also been sought to

Preview of Stinson's Model B Airliner



Thanks, fellows. In response to last month's requests for gossip, criticism and suggestions for this page, we got enough letters to fill a small blimp. Keep up the good work, please. We'll take care of requests in order of their arrival. Address your correspondence to

MAJOR AL WILLIAMS, *Manager Aviation Department*
Gulf Refining Company, Pittsburgh, Pa.

NOW YOU TELL ONE!

"A FRIEND tells me that in the days when ships were young and pilots were Frank Merriwells, the following incident actually happened.

"A barnstormer, after a take-off, found that he'd damaged his landing gear. Mildly disturbed, he kicked a hole through the fuselage, hung by his knees and fixed the gear with a piece of wire.

"If this is true, can any old-timer give me the man's name?" —P R S

DID YOU KNOW?

That there actually was a Darius Green? Albert Damien, Scotch but not canny, made wings with a feather covering and jumped off a barn. He didna jump again.

That when Pilate de Rogier and Marquis d'Arlandes were about to make the first ascension in a free balloon, there were suggestions that condemned criminals go up instead and be pardoned if they survived.

That at the All-American Air Races held in Miami, December 12 to 14, Gulf products won 8 out of 9 race events, established two world's records and one national record.

BIG MOMENTS IN AVIATION

5 Years Ago:—Feb. 4, 1931—U. S. Navy dirigible Los Angeles leaves Lakehurst, N. J., at sundown. Arrives at Guantanamo, sundown Feb. 5.

7 Years Ago:—Born at Gulf's Port Arthur Refinery, a new refining process, the Alchlor process, that made possible the world's greatest motor oil, *Gulfpride*.

In 1935, at National Air Races, Harold Neuman, Thompson Trophy winner, and Benny Howard, first in Bendix race, fly ships lubed by Gulfpride.

10 Years Ago:—Feb. 10, 1926—Commander Franco concludes his flight from Spain to Buenos Aires, via Canary and Cape Verde Islands.

SQUAWK!

"I think this 'temporary' restriction of regular airways in overcast weather to transport pilots and airmen with proper radio equipment is an outrage. I can keep out of the way of transport pilots in fair weather or foul." —B D F.

REBUTTAL!

B. D. F. just showed me his letter and I claim he should be taken out and paddled. This 'temporary' restriction should be made a PERMANENT measure. This rule will save plenty of skins, maybe even B. D. F.'s own hide. —R. T. M.

THIS MONTH'S WHOPPER

"I shall never use your Gulf Aviation Gas again.

"Last week I tried it in my plane and it gave the ship so much zip that I decided to use it to my car. So I filled the tank and started to drive to town from the Floyd Bennett Airport.

"The fool car started soaring into the air. I took my foot off the accelerator, but the darn bus still kept on climbing.

"Imagine my embarrassment! I was pointed towards Chicago, and nobody to save me when the gas ran out! I did some tall thinking and decided to rig up a parachute. I took off my shirt, pants and underwear. I tied them together and pasted the seams with tire tape.

"About Youngstown I bailed out. The parachute worked. But it was sure one cold trip down!

"I landed in Warren, Ohio, and they took me to an asylum. Two days later they let me out.

"The last I heard of my car it was reported to be sailing over the Fiji Islands, and still going strong.

"I guess a little Gulf Aviation Gas will take you a long way. *You*, not *me*, I mean. —F. H. J.

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WHEN YOU BUY A NEW SHIP SPECIFY
GOODYEAR AIRWHEELS★ AND
GOODYEAR AIRPLANE BRAKES

THE GREATEST NAME

GOODYEAR

AMERICA'S LARGEST LANDPLANE USES GOODYEAR TIRES

. . . controlled by new Goodyear PNEUMATIC BRAKES

PICTURED here is the Boeing 299 bomber—giant four motored ship with a gross weight of 16 tons, holder of the proud title of the world's fastest and longest range bomber.

Notice the tires, shoulder high to a man—the largest ever built for airplane use in America—latest development of that matchless soft-tire experience which has put Goodyear out in front as tire-builders for aviation.

And with these giant Goodyear tires go another new Goodyear devalopment—*Pneumatic Brakes*—for the first time on American airplanes.

To make these pneumatic brakes successful, Goodyear has developed new metering or control valves which feed air to the brake unit in any amount desired—supplying pressure great enough to give the pilot pedal control without intricate boosting systems or auxiliary manual control—even on a 16 ton airplane. The brake unit used is the highly efficient Goodyear disc metal-to-metal clutch design.

A full year and more of rigorous test has demonstrated the complete success of this newest Goodyear brake.

No wonder these brakes are featured right along with the automatic pilot—two-way radio telephone—radio homing device and a long list of other modern developments as *news* on the greatest of ships.

Goodyear can furnish tires, tubes, wheels, brakes and brake controls for airplanes of every type and size.

For full information, write Aeronautics Department, Goodyear, Akron, Ohio, or Los Angeles, California.

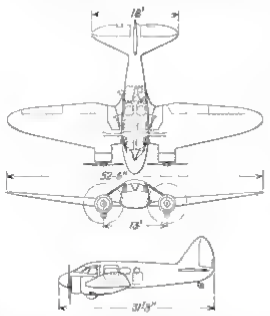
IN RUBBER

GOODYEAR

reduce the expense of maintenance.

In figuring on single engine performance, the airplane, fully loaded, has been calculated to maintain level flight on one engine at 4,000 ft. From higher altitudes, advantage may be taken of the very flat gliding angle obtained with a single engine operating. For example, if an engine failed at 10,000 ft., the fully loaded plane could be flown for 10 minutes (or for 19 miles) on one engine before coming down to 8,000 ft. An additional 26 miles (or 14 minutes) of flying would be required before descent to the 6,000-ft. level, and 50 minutes more (or 85 miles) would elapse before the plane came down to its normal single ceiling of 4,000 ft.

The general characteristics are as follows: span 52 ft. 6 in.; length overall, 31 ft. 8 in.; wing 357 sq.ft.; horizontal tail area, 78 sq.ft.; vertical tail area, 32 sq.ft.; weight empty, (including standard equipment) 4,500 lb.; useful load (including 1,150 lb. payload, 720 lb. fuel, 60 lb. oil, 170 lb. pilot) 2,100 lb.; gross weight, 6,600 lb. Estimated performance: cruising speed, 6,000 ft. D.A., 160 m.p.h. at 3,000 ft. D.A., 155 m.p.h. at 1,000 ft. D.A., 152 m.p.h.; rate of climb (initial), 1,150 ft. per min. Service ceiling, two engines, 16,000 ft., one engine 3,800 ft.; take off run, 650 ft.; range (with 150 gal.), 900 miles.



Stinson's Model B Airliner

New Kinner Engine

The SC-7 develops 370 hp. at 1,900 r.p.m. at 5,000 ft.

EARLY among the 1936 crop of new engine models comes announcement of a new Kinner (Kinner Airplane & Motor Corporation, Ltd., Glendale, Cal.) with a somewhat higher rating than any heretofore built by this company. This engine follows the generally simplified design concept of prior models. It shows however a number of modifications to help performance and maintenance, such as a gear-driven supercharger, rearrangement of accessories on the rear section, and semi-automatic valve gear lubrication.

Cylinders are of the composite type with aluminum heads screwed and shrunk on to a forged steel cylinder barrel. Both inlet and exhaust ports are at the rear. Rocker boxes are interconnected by a manifold which emits lubricating oil to the rockers and valve springs under control of the pilot.

Crankcase is in two sections, cam ring and supercharger impeller are in the rear section. The impeller is of the General Electric centrifugal type driven at 9.7 times crankshaft speed.

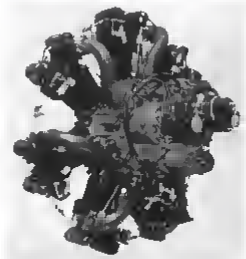
Accessory drives on the rear case do not run through the impeller chamber, but are driven from an extension on the crankshaft. Space is provided for two magnetos, electric starter, generator, fuel pump and two additional drives which may be used for gun synchronizers, vacuum pump, hydraulic pump or constant speed propeller control.

Mounting lugs are cast on to the rear case. Each lug is provided with a rubber insert to cushion the engine against vibration.

The crankshaft is of the two-piece type, used with a one piece connecting rod. The shaft is carried on three anti-friction bearings. Connecting rod bearings are of the steel-back, copper lead type. Pistons are forged aluminum alloy.

The accessories have been grouped on the rear case with an eye toward reduction of fire hazards. All electrical accessories are mounted on or above the center line of the engine and other accessories such as fuel pumps, carburetor and oil pumps, etc., are below the center line. All accessories are amply spaced.

The general specifications for this engine are: rated brake horsepower, 370; power available for take-off, 385 hp.; rated r.p.m., 1,900; critical altitude, 5,000 ft.; bore, 5¾ in.; stroke, 6 in.; displacement, 1,400 cu.in.; compression ratio, 5.5 to 1; blower ratio 9.7 to 1; carburetor, Stromberg NAR9A; magnetos, Scintilla; overall diameter, 47¾ in.; overall length, 45⅛ in.; total weight dry, 650 lb.; specific weight (dry) 1.7 lb. per hp.



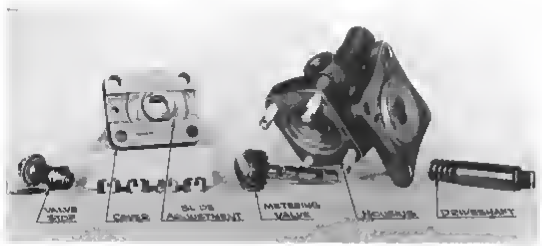
Front and rear views of the new Kinner SC-7, 370-hp. engine

Precision Oiler

Automatic metering pump now feature of Wright valve gear lubrication system

AIRLINE maintenance men are apt to rate the development of automatic valve gear lubrication systems one of the most important technical advances made in their field last year. Such systems on Wright engines were described in the November issue, on Pratt & Whitney engines in the September issue.

Now Wright announces a further development of its installation. Originally a control valve was provided on the rear section of the crankcase which, when depressed, admitted sufficient oil



The new metering pump for Wright automatic valve gear lubrication systems disassembled.

into the system to provide lubrication for several hours of operation. This is now replaced by an entirely automatic metering pump. Through it engine oil is led by means of an external line to the No. 1 cylinder, from which it is fed through a system of tubes connecting all cylinders in a complete and continuous circuit. As the quantity of lubrication entering the valve gear lubricating system coincides with that consumed, no surplus oil is returned to the main oil supply. It may be adjusted to provide a flow ranging from 0 to 3 pts. per hour.

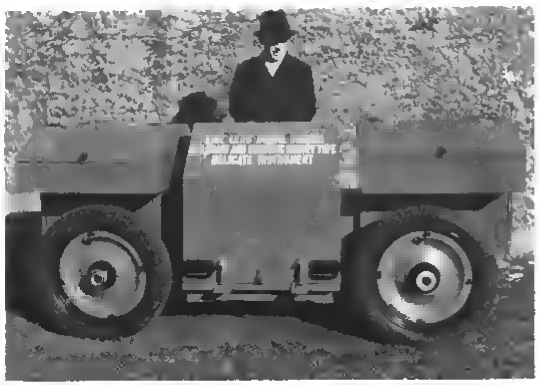
The driveshaft, located in the mounting flange of the lubricator housing, is engaged on the engine accessory drive by its torque end. The driveshaft worm drives the valve shaft gear which is located in the main part of the housing at such an angle to the worm shaft that the drive gear teeth are straight rather than angular.

The valve stop consists of an adjustment screw and a ball end. This is inserted in the slide adjustment which moves in a slot provided in the cover. The whole is fastened to the housing by means of studs. The ball end of the valve stop contacts the angular end surface of the valve shaft causing the shaft to reciprocate as it rotates. The length of the stroke, and therefore the oil volume displaced, is determined by the amount of off-set of the ball from the valve shaft center which is indexed on the cover and slide adjustment. A spring and plunger (not shown in the photograph) are inserted in the end of the housing opposite the gear chamber to maintain proper contact of the valve against the ball adjustment.

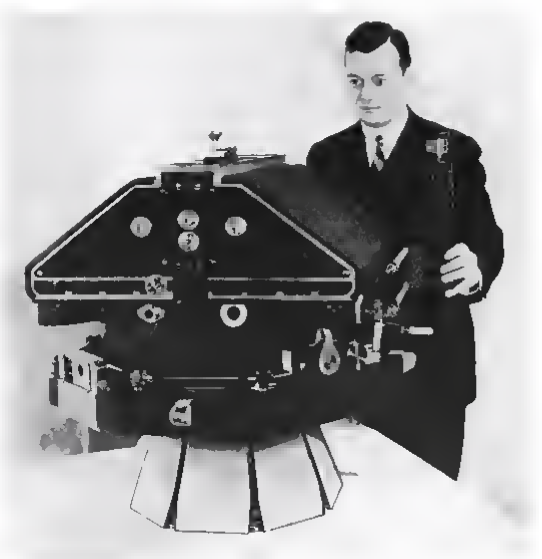
Pressure oil from the engine enters the lubricator by means of any one of four holes on the mounting flange depending on the manner in which the lubricator is assembled on the engine. Through a drilled passage in the housing the oil flows to the valve stem bore, where the slot farthest from the gear admits a sufficient quantity of oil to the axial hole in the stem to fill the cavity. Reciprocation of the valve forces the oil out into the distributing system when the second slot on the valve stem coincides with the lubricator outlet which is a tapped boss on the top of the housing.

Variation of the indexing of the slide adjustment on the cover provides for the regulation of the valve stroke thus controlling the amount of oil entering and leaving the slots in the valve stem.

The lubricator may rotate in either direction, provision being made for proper valve action by reversing the position of the cover.



The special truck for handling the camera on the ground.



Sherman Fairchild with his new nine-lens camera.

Colossal Camera

Fairchild develops 305-lb. nine-lens unit, largest ever built

When Fairchild Aviation Corporation announced its giant ten-lens camera last July, it was the ne plus ultra of aerial mapping machines. Flying at an altitude of 10,000 ft., a strip of land about 10 miles wide could be photographed with a single exposure.

Already that camera is outdated. Last month Sherman M. Fairchild announced its successor, developed for the United States Coast and Geodetic Survey. The new camera is a single unit—the older one was two five-lens cameras mounted on a common base—with nine vertically-mounted F4.0 lenses. It is the largest single-unit aerial mapping camera ever made. The center lens photographs

directly, while the other eight lenses photograph images reflected on eight highly polished steel mirrors extending below the camera. These mirrors are mounted in an alloy steel frame, and slant outward at the bottom at an angle of 19 deg. They are set at an angle of 45 deg. to each other, thus forming an octagonal cone.

Lenses are actuated by nine electric motors, operated synchronously. Inside the lens chamber are four supporting lenses which record on the film time of exposure, checking points for corrections when the film is developed, negative reference number, and spirit level readings taken at the time of exposure for corrections in perspective.

Above the lenses are the film spools, which take 200 ft of 23 m wide film—enough for 100 exposures. All nine exposures are recorded on a single film, eliminating the necessity for separate development and assembly into a mosaic.

Focal length of the new camera is 8½ in—2¼ more than the five-lens instrument. While this reduces the area in the field of the lenses, it increases the sharpness of detail.

Operation of the camera is simple. It photographs downward through the floor of the plane, being raised or lowered for this purpose by means of slings attached to the airplane roof. When in position for use, the mirrors extend 8 in. below the bottom of the fuselage. A metal shield is installed about 4 ft. in front of the mirrors to protect them from the unbalancing effect of the slip-stream and the damaging particles that are carried with it. When the operator is ready to photograph, he surveys his field through a special automatic telescopic sight attached to the side of the camera. This sight includes a hair-line grid to enable him to adjust the camera on its mount to compensate for drift. A moving wire to automatically regulate overlap—adjustable from 10 to 75 per cent—operates the switch controlling the shutters.

New Western Electric radio compass equipment installed

Radio Compass

Western Electric develops rotatable loop system

A VISUAL-INDICATOR radio compass for aircraft has been developed by Bell Laboratories, Inc. It consists of an adjustable loop antenna, a non-directional antenna, and a compass control unit. It is designed for use with the Western Electric 17A receiver (AVIATION, August, 1935), a light, two-band set for private plane use.

The compass control unit has three tuning ranges, which used with the loop and the non-directional antenna permits the pilot to obtain bearings on either the regular broadcast band (550 to 1,500 kc.) or the Department of Commerce radio beacons (200 to 400 kc.). Bearings may be taken either from two appropriate stations (obtaining from their directions a cross-bearing) or by "homing" directly on a single station.

The loop is mounted in a streamlined housing, and may be placed above or below the fuselage. It is turned with a hand wheel, a dial showing its position relative to the axis of the plane.

The principle is the same as with other radio compasses. Maximum signal is heard when the radio waves are traveling in the plane of the loop, and the signal is at its minimum when the waves are perpendicular to the loop. But as the loop determines only line of direction, a non-directional antenna is required to determine the "sense" of the direction.

The course being flown, in relation to the direction of the radio station, is indicated by the dial on the hand wheel of the loop. This course is maintained by a combination of visual and aural indicators: visually with a pointer on the instrument panel showing which way to turn the loop, aurally by a super imposed, low-pitched tone which disappears when the loop is in proper position relative to the sending station.

Total weight of the apparatus, in its present experimental stage, is somewhat less than 50 lb., broken down as follows: loop, 15 lb.; compass control unit, 9½ lb.; receiver, 9½ lb., and the power supply assembly, 11 lb. The shielded cable connecting the loop with the control unit weighs about 2 lb.

The dimensions of the control unit are about the same as those of the receiver—8 in. square. The power supply occupies slightly more space.

Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

All Gas, No Water

Automatic valve prevents pumping water out of gasoline tanks

ONE thing that cannot be tolerated in aviation or automobile gasoline is water, and the Swift Lubricator Co. (Elmira, N. Y.) has just announced a new automatic foot-valve to prevent pumping water out of the bottom of gasoline storage tanks. Operating element of the valve is a float which will sink in gasoline but will float on water. As the level of water in the bottom of the storage tank rises, the float rises also, until, before the water level reaches the level of the suction pipe, a disk valve closes off the flow. The valve body is made of bronze, can be easily applied, and will last indefinitely. The company reports that several of the large airlines have purchased these valves for installation in storage tanks at their fueling stops. — AVIATION *February 1936*

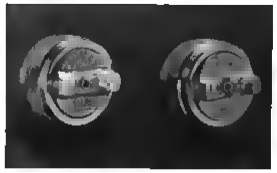
Visic valve (Swift Lubricator Co.)

Caps and a Cup

A disposable paper paint cup and two new air caps by DeVilbiss

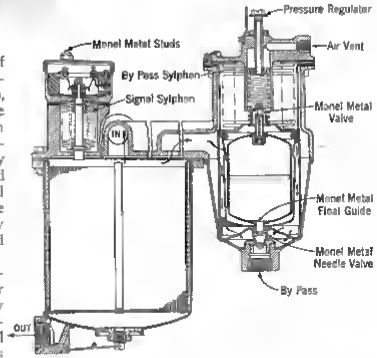
ON SPRAY-PAINTING jobs requiring frequent changes of color or material, cleaning out paint containers is expensive. To obviate the necessity of cleaning them, The DeVilbiss Company (Toledo, Ohio) has developed a one quart capacity cup which may be inexpensively discarded after use. It is a heavy paper cylinder with a flanged upper edge and light metal bottom. Attachment to the cup holder requires only slight bending of the fluid tube.

The company has also developed two new air caps for use on the Type MBC spray gun. No. 76 cap is for volume production industrial work with lacquers, primers and heavy-bodied synthetics. It has three auxiliary atomizing jets which give a wide straight sided pattern. No. 54 cap is a twin-jet type, designed to give a wider spray without split. — AVIATION, *February 1936*.



Two new caps for use on the DeVilbiss MBC spray gun and (left) a disposable paper paint cup

Below: A safety signalling device to guard fuel flow



Fuel Flow Signal

New device flashes light if trouble develops in the system

TO WARN the pilot of interruption in the flow of fuel from tanks to pump, The Steel Products Engineering Company (Springfield, Ohio) has developed an automatic signaling device. It consists of two small chambers mounted between fuel tanks and the fuel pump. The fuel enters the main chamber at the top, driving the air out ahead of it through a cored passage in the top casting, thence into a by-pass, to be exhausted above the tanks. Fuel overflowing from the first chamber fills the second bowl, raising a float to which is attached a needle valve. This valve shuts the air vent, allowing incoming fuel to build up pressure. This pressure, controlled by a regulator with an indicator graduated in pounds, collapses the signal syphon mounted above the main bowl, thus turning off a light on the instrument panel. The light remains off as long as pressure is maintained, and as the air valve is controlled by fuel level and is not sensitive to pressure, air entering the system when fuel tanks are switched has no effect on the light control. The strainer in the reservoir bowl is of sufficient capacity to require cleaning only after 100 hours or more of operation. — AVIATION *February 1936*

Operator's Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 13 What is the price asked for your shortest flight? Have you ever offered flights at a lower price and if so what was the result? Have you had other ships barnstorming at your part charging less and if so what was the result of their operations? Have barnstormers using Fords or similar equipment and charging only $5, $5, and 75 cents helped or enlarged your business? (Submitted by George C Duroll, Mississippi Airways Burcupoet, In)

Association sets minimum

THE price for our shortest flight is $1 50 Lower prices have been charged here at Boeing Field, and slightly higher prices have been charged. Those who have charged lower prices have agreed that anything less than $1 50 is not enough, but $2 seems to be a bit too high.

All members of the Seattle Aviation Industries charge $1 50 as a minimum per person. If after the passenger is up in the air he decides he wants to see more of the city or go for a longer ride he has the privilege of telling the pilot just how much further he wants to go and just how much longer he wants to stay up. An additional charge is made depending on the time required to go where the passenger wishes He is charged so much per minute for the extra time, and the plan works very well

Barnstormers using a Ford tri motor have apparently been able to make expenses when charging a dollar a ride but only when doing a volume business — A Elliott Merrill, *President Washington Aircraft & Transport Corporation Boeing Field, Seattle Wash*

No advantage below $1.50

THE price asked for our shortest flight is $1 50. We have offered flights at lower prices but the result was not advantageous to us. We have not had any opportunities to observe the results of barnstorming with large ships for low priced rides—*The H C Robbins Co. Cleveland Airport, Cleveland, Ohio*

Need volume for low price

AT Huntington Airport we have never permitted short flights or hops for less than $1 and this price during the past year only There have been barnstormers using both tri-motor equipment and small planes flying in the vicinity of Huntington, charging 50 cents and 75 cents per flight, and I am positive that such practice has retarded the short flight business and has practically eliminated all profit except on special occasions when extra effort has been devoted to the advertising and entertainment to bring a large crowd to the airport, when the number taking flights might justify some reduction in price.

From years of observation of barnstorming practice the pilots who operate at these ridiculous prices are generally eliminated from the business when their equipment needs to be renewed or overhauled. I am confident that there cannot possibly be any profit in carrying passengers for less than $1 unless the equipment is in constant service.—H G Mayes *Manager Huntington-Chesapeake Airport Huntington W Va.*

★

QUESTION 14 What do you think of the present regulations for medical examinations for flight students? Do they discourage students from getting started because of the expenditure of time or money involved Would there be any great risk in amending them to defer the examination until the student had several hours of dual? Should the number of medical examiners be increased or should the examination privilege be extended to other physicians? Should the Air Commerce Bureau permit operators to charge for the flight demonstration time up to one hour that is now allowed only if given free?

Should charge for demonstration

WE believe the present regulations for student medical examinations are satisfactory but they do discourage students from getting started because of the time and money involved There would be no great risk in amending the regulations so that the examination could be deferred until the student has had several hours of dual.

In this section of the country the number of medical examiners is about right We believe, however, that the regulations should permit operators to charge for the flight demonstration time up to one hour, which now must be given free.—*The H C Robbins Co., Cleveland Airport Cleveland, Ohio.*

Makes instructors outlaws

I FAIL to see any reason why a student pilot should be discouraged by having to pay $10 for an examination before he knows whether or not he is going to like flying. I believe that a student should be allowed to receive dual instruction until he is ready to solo Then he would be glad to get the permit which should be required before soloing.

It is a fact that many an instructor has violated the regulation and given student instruction to those without permits It's a shame that some instructors have to be outlaws or miss meals

The student pilot permit has little or nothing to do with the hazard of learning to fly when a good instructor is in charge If the instructor watches his students closely he can discover any trace of physical defects that are holding the student back

I have soloed 90 rank students and checked out over 50 others and have not had the slightest bit of trouble

I do believe that the prospective student should understand that he will have to have a permit before he will be allowed to solo and that he may take the examination as soon as he wishes

I have lost many a student just because I told them that they would be required to get a permit Maybe I was not a good enough salesman to sell them the permit and flying time both

I know of nothing that the Bureau of Air Commerce could do, that would cost so little, and do so much good, as to amend the present regulation pertaining to the student pilot permit—Glen T Clark, *Charleston, W Va*

Question 15

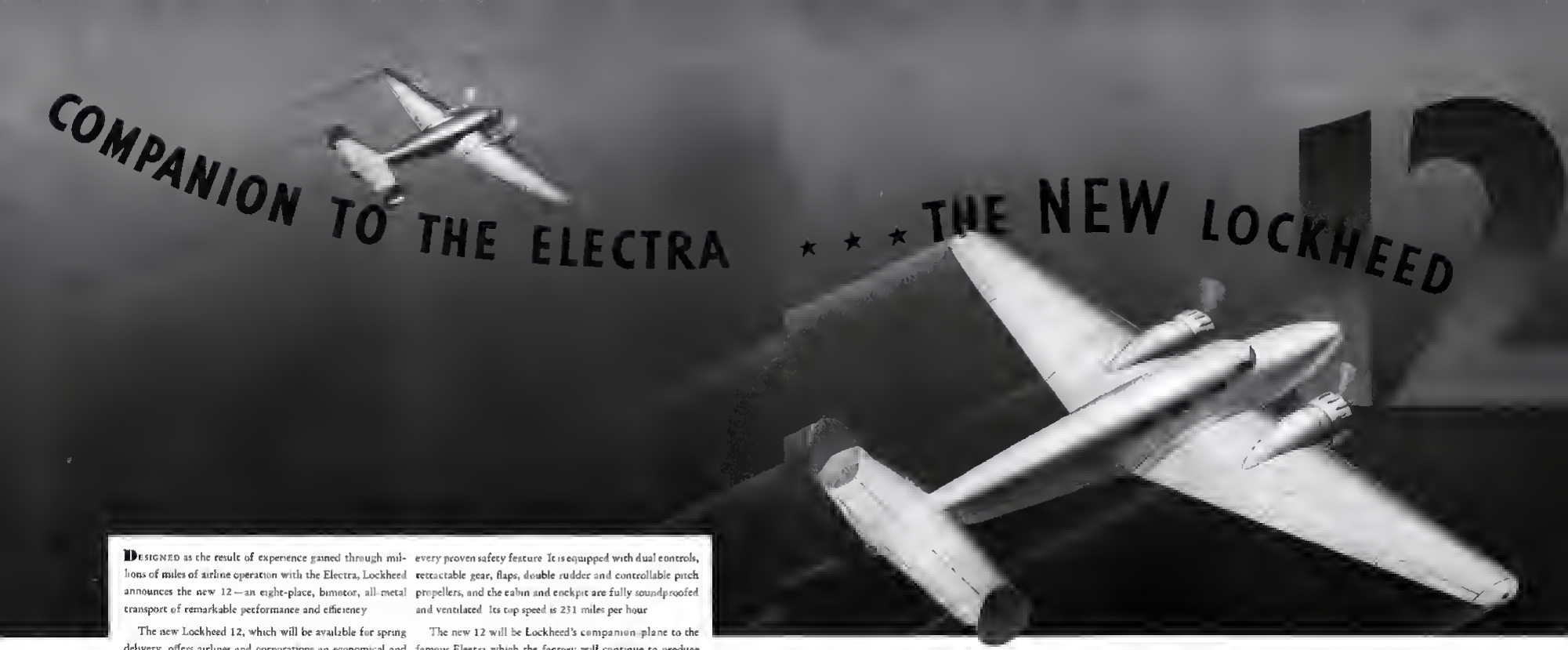
(Answers will be published in March)

DO YOU give free instruction in plane purchases? If so do you give them any further instruction beyond solo? Do you charge for demonstration time given in selling airplanes? In the sale of planes for executive or business service do you give the prospect an opportunity to use the ship on trial?

Question 16

(Answers will be published in April)

WHAT is your method of estimating fares for taxi service? Do you base the charge on a straight mileage basis or on other factors? Do you charge an extra premium for night flying or flying under unusual conditions? Have you found your charges agreeable to customers?



DESIGNED as the result of experience gained through millions of miles of airline operation with the Electra, Lockheed announces the new 12—an eight-place, bimotor, all-metal transport of remarkable performance and efficiency

The new Lockheed 12, which will be available for spring delivery, offers airlines and corporations an economical and completely appointed airplane with every proven safety feature It is equipped with dual controls, retractable gear, flaps, double rudder and controllable pitch propellers, and the cabin and cockpit are fully soundproofed and ventilated Its top speed is 231 miles per hour

The new 12 will be Lockheed's companion-plane to the famous Electra which the factory will continue to produce and which has established itself as one of the world's fastest and most economical airplanes.

Lockheed ELECTRA

	10A P & W Wasp Jr "SB" 450 H P @ 2300 R P M.	10B Wright Whirlwind 440 H P @ 2200 R P M.	10E P & W Wasp Se 550 H P @ 2200 R P M.
Maximum Rate of Climb, sea level (wheels up)	1,100 Ft /Min	1,230 Ft /Min	1,200 Ft./Min
Cruising Range	690 Miles	680 Miles	685 Miles
Absolute Ceiling (Both Engines)	23,200 Ft	20,700 Ft	27,900 Ft
Absolute Ceiling, full load, one engine	5,800 Ft	4,000 Ft	9,000 Ft
Absolute Ceiling, half fuel dumped, one engine	7,000 Ft	5,000 Ft	9,500 Ft
Maximum Speed at sea level	190 M P H	200 M P H	195 M.P H
Maximum Speed	210 M P H	200 M P H	215 M.P H.
Cruising Speed, at altitude (M P H)	195 @ 9600	186 @ 7000'	205 @ 9600'
Airplane Gross Weight	10,100 Lbs.	10,000 Lbs	10,500 Lbs.
Airplane Empty Weight (with Standard Equipment and W E 2-way Radio)	6,325 Lbs	6,300 Lbs	7,100 Lbs.

Lockheed 12

	12A P & W Wasp Jr "SB" 450 H.P @ 2300 R P M.	12B Wright R975 E3 440 H P @ 2200 R.P.M.	12F Wright R760E3 320 H.P @ 2200 R.P.M.	12M Menasco C6S4 295 H.P @ 2400 R P M.
Maximum Rate of Climb, sea level (wheels up)	1,400 Ft./Min	1,450 Ft /Min	1,000 Ft./Min.	850 Ft./Min.
Cruising Range	650 Miles	640 Miles	775 Miles	900 Miles
Absolute Ceiling (Both Engines)	27,000 Ft	25,200 Ft.	21,000 Ft.	18,600 Ft.
Absolute Ceiling, full load, one engine	10,200 Ft	8,300 Ft	4,200 Ft.	2000 Ft.
Absolute Ceiling, half fuel dumped one engine	11,000 Ft	9,750 Ft.	5,100 Ft.	3,500 Ft.
Maximum Speed at sea level	219 M.P H.	224 M P H	202 M P H	186 M P H
Maximum Speed at 5000 feet	231 M P H.	221 M P H	197 M P H	195 M P H
Cruising Speed, at altitude (M P H.)	209 @ 10,000	205 @ 7,500'	193 @ 7,500'	182 @ 7,200'
Airplane Gross Weight	7,925 Lbs	7,925 Lbs	7,460 Lbs	7,460 Lbs.
Airplane Empty Weight (with Standard Equipment and W E 2-way Radio)	5,355 Lbs.	5,355 Lbs	4,905 Lbs.	4,905 Lbs.

LOCKHEED AIRCRAFT CORPORATION • BURBANK • CALIFORNIA

New York Office—614 Chrysler Building • Dallas Office—Hangar No. 4, Love Field

LOCKHEED

News of the Month

★ ***Transport*** **. . . Railway Express Agency wins six airlines from General Air Express . . . Big line officials discuss unified procurement program . . . Western Air Express, Pennsylvania, American and United report great traffic increases for 1935 . . . Cleveland passengers show biggest terminal advance . . . American budgets for 50 per cent increase in 1936 . . . TWA pilots become "captains" . . . American Airlines to put seaplane service on N. Y.-Boston run.**

★ ***Army*** **. . . Air Corps decision delays pursuit contract . . . Obsolete equipment put into separate category.**

★ ***Industry*** **. . . Northrop, Consolidated, Douglas, Taylor, Boeing report growing payrolls . . . Curtiss works on mock-up of 40 passenger transport . . . Stinson's distributors meet at factory . . . Waco begins Brazil deliveries.**

★ ***Flights*** **. . . Hughes breaks transcontinental record . . . Ellsworth found safe at Little America after brilliant flight across Antarctic Continent.**

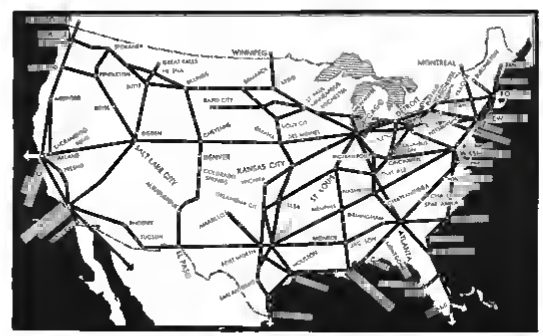
★ ***General*** **. . . Bureau in campaign against passenger carrying by student and amateur pilots.**

Happy New Year

Railway Express Agency makes big gains. Operators discuss unified equipment program. Lines report big gains during 1936. Expect further progress in 1936

IN OUR January issue we reported in these pages no less than four important inter-airline goals had been achieved during December—scrip books, insurance for commercial travelers, traffic rules for instrument flying into busy terminals, and an independent association.

Last month progress continued. Jan 9, President L. O. Head of the Railway Express Agency announced the virtual completion of a project forecast last August. For several years nine lines, including American, EAL and TWA, have conducted all express business through the General Air Express, a sizable competitor for the other lines' Railway Express Agency service. Feb. 1, according to Mr. Head's announcement, six of the above mentioned lines will change their express allegiance to the Railway Agency. After that date only TWA, Weddell-Williams, and Catalina will remain outside a single unified system that includes 22 domestic lines, the far flung network of the Pan American Airways System, and the pick-up and delivery facilities of some 23,000 Railway Express Agency offices. At TWA offices it was admitted, "that the subject was still under discussion."



R.E.A.'s new air express system

Another important development of the past month promises to affect the manufacturing branch of the aeronautical industry as well as the airline operators. Jan. 11 came the first public disclosure that a long series of meetings had been held between executives and engineers of a number of the most important airlines with the object of perfecting a plan for a unified equipment procurement program.

In place of the present rivalry which duplicates development costs, and sets an obsolescence period of three years on expensive transport planes, the conferees propose to set up specifications for new ships that fit as far as possible the requirements for all the major airlines. Then all the lines would share in development costs, testing, and in ultimate production-basis orders.

C. R. Smith of American, E. V. Rickenbacker of Eastern, Franklin Gledhill of Pan American, Jack Frye of TWA; and W. A. Patterson of United attended the meeting in Chicago at which the plan was first released to the press. More definite announcements are expected after further conferences.

Western Air Express last month reported on spectacular advances during 1935. Passengers increased from 7,401 in 1934 to 13,700. Passenger-miles which stood at 3,336,738 in 1934 rose to 4,908,915. Express jumped 168 per cent, from 73,158 lb. to 196,500. Mail built up from 208,197 to 298,801 lb. President Alvin P. Adams also announced that the ratio of completed to scheduled flights had moved ahead, from 94.65 per cent to 99.15.

Preliminary figures for last year's traffic on the country's domestic lines reveals United Airlines as once more the outstanding leader. During 1935 it flew 15,000,000 airplane miles, carried 180,000 passengers, 6,600,000 lb. of mail and 1,800,000 lb. of express. These totals approximated 30 per cent of the country's passenger mileage, 44 per cent of the airmail, 50 per cent of all air express. United's gross income for the year will approximate $8,500,000, $3,000,000 of it from mail.

United's big traffic had much to do with the tremendous gain of 43,000 passengers logged last year through Cleveland's air terminal, an increase of 43 per cent over 1934 figures, to a total of 145,666. Chicago handled 191,000 compared with 165,000 the year before. Newark traffic rose 23 per cent during the first nine months of the year; total figures were not available at press time. San Diego traffic was reported up 60 per cent.

Following a lead instituted by Pan American for its Clipper crews, TWA last month announced that henceforth its first pilots will be known as "Captains," its co-pilots as "First Officers." Its new stewardesses will be known as "Air Hostesses," its transportation agents at terminals as "Passenger Agents." The title "Radio Dispatcher" hitherto used will be simplified to "Radio Man" to avoid confusion with Flight Dispatchers, all of whom on the TWA system have had long careers as pilots. TWA also announced a schedule change for its Sky Queen service to permit better connections with airlines to Florida during the winter vacation season.

Pennsylvania Airlines, which a year ago completed replacing its former fleet entirely with Boeing transports, reports an astounding increase of traffic. In 1935 passengers carried rose from 14,128 to 40,237, a 185 per cent increase. Air express grew 365 per cent during the same period.

National Parks Airways will spend $100,000 in the near future in converting its Boeing 247 transports into 247-Ds and in remsulating their cabins against noise and vibration. Purchase of an additional ship (of the D model) will also be completed within a week or two.

Delta Airlines received the third of its three Lockheed Electras last month and immediately inaugurated new schedules, slashing two hours and fifteen minutes from its present Dallas-Atlanta schedules and extending passenger service to two trips formerly operated for mail and express only.

Boston and Maine Airways Jan. 2 doubled its week day service on the Boston, Portland, Waterville, Bangor route.

American Airlines which carried 178,209 passengers last year compared with 103,745 during 1934 has announced a 1936 budget based on a further 50 per cent increase during that period.

Airline Coordinator

Col. Edgar S. Gorrell made head of the Air Transport Association

EVER SINCE airline operators left the Aeronautical Chamber of Commerce they have been negotiating in Chicago to form their own association. They felt that their problems were so specialized that they could be better solved under such a set-up.

The middle of January W. A. Patterson, United Air Lines president and chairman of the organization committee of the new Air Transport Association of America, announced the operators' choice for "air transport coordinator." He is Col. Edgar S. Gorrell, wartime Chief of Staff of the Air Service. He has been a pilot for 22 of his 44 years. In 1916, after graduation from West Point as an honor student, he was adjutant of the First (Aero) Squadron, under Pershing, and saw service in the Mexican expedition. Following the War, in which he served on all five fronts, he represented the United States at more than 200 international conferences.

In 1925 he joined the Stutz Motor Car Company, and was its president from 1929 until he resigned last August. His new job is reported to give him powers comparable to those of Will Hays of the movies or Commissioner Landis of baseball, adjudicating disputes and administering the operators' voluntary code.

Number two man in the ATA is Fowler W. Barker, who served under Leighton W. Rogers in the Bureau of Foreign and Domestic Commerce. For the past few years he has been with the Aeronautical Chamber, organizing the operating and maintenance subcommittees.

Pier to Pier

New York-Boston route to see experiment with water terminals

(1) A MAJOR PROPORTION of American intercity travel flows between neighboring large cities 75 to 250 miles apart. (2) Airlines have rarely been able to tap such streams because time consumed by travel from city centers to outlying airports destroys their speed-in-transit advantage. (3) Yet a large proportion of big American cities have bodies of water near their built up districts that could be used for seaplane operations.

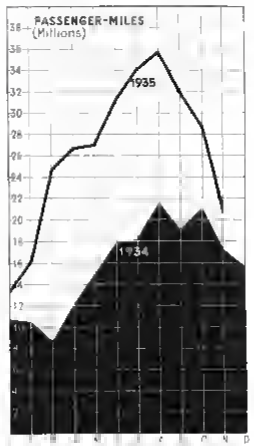
Such is the usual take-off for a proposal which has been current in this country since the beginning of air transport operations—Why not use seaplanes or amphibians in short haul operations?

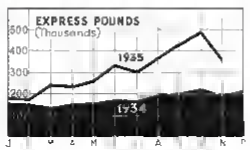
What looks like its first large scale test is promised for 1936 along the New York-Boston route.

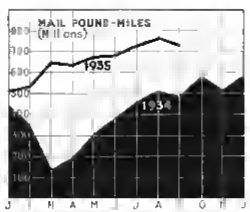
American Airlines has announced it will mount some of its Condor equipment on floats and experiment with a service from one of New York's new seaplane terminals in the East River to a terminal on the Boston waterfront. Calls at New Haven, Newport and other coastline cities are under consideration.

Traffic

Latest available statistics from the Bureau of Air Commerce and the Post Office Department—Domestic airlines only







An entirely new company, the Marine Airlines, Inc., has also released details of a service along the same route to start next summer using Sikorsky S43 amphibians. Like American, it too will use an East River terminal and it has made definite arrangements to operate into Boston's well-known Fish Pier, located a few minutes from South Station. It has ordered three of the 190 m.p.h. amphibians pending S.E.C. approval of its stock issue.

Officers of Marine Airlines President, James M Eaton (once vice president of Pan American, then president of Ludington New York-Washington airlines); directors, Nicholas S Ludington, Laurence M Marks, Benjamin B McAlpin, Jr, J Brooks B Parker, David Van Alstyne, Jr., Allen Walker, Richard Reeve (Prudential Insurance 2d vice-president and Pennsylvania Railroad director).

Arkansas Crash

Airline accident kills fourteen passengers and three of crew

THE FIRST fatal airline accident of 1936 occurred Jan 14 when an American Airlines plane crashed near Goodwin Ark, killing fourteen passengers and the crew of three

The plane was "The Southerner" a twin-engine, 14-passenger Douglas (DC2) enroute from New York to Fort Worth, Tex., on Flight 1 of American Airlines' two daily transcontinental runs At the time of the accident, the plane was flying between Memphis Tenn, and Little Rock, Ark It left Memphis at 7 04 p m —29 minutes late The last that was heard from the plane was an all-well report about fifteen minutes later.

The plane crashed in an inaccessible swamp mid-way between Memphis and Little Rock, and was missing for four hours before a searching party could reach it. The pilot was Jerry Marshall, who a year ago was one of the pilots who inaugurated American's double daily transcontinental service The other two members of the crew were co-pilot Glenn Freeland, who in 1932 was manager of the Joplin, Mo., airport, and Miss Perla Gasparini, the stewardess

As we go to press a Bureau of Air Commerce investigation had eliminated "all but the personal element."

Ellsworth Rescue

Found safe after brilliant flight. Merrill gets plane to Magallanes

JUST 46 days after Lincoln Ellsworth and his pilot Herbert Hollick-Kenyon disappeared Nov 23, the Discovery II, which had been on its way from England to Australia for a research whaling expedition, sailed into the Bay of Whales to find them both alive and their plane intact within 20 m. of their announced objective Bad weather had interrupted their flight four times, delayed its completion until Dec. 5. Finally their fuel ran out within a few minutes flight of their goal A failure in their antenna switch and lead had been the cause of their radio's failure

Rushing a plane from the United States for a proposed search from the Wyatt Earp itself developed into a considerable task. Frank Hawks, in charge of rescue arrangements in this country completed the purchase of a Northrop Gamma within a few days of Ellsworth's disappearance and dispatched it from Newark, N J, Dec 7, with Russell Thaw as pilot, William Klenke as mechanic-radio operator Weather delayed them on their trip south Two days later their engine failed on a take-off from the Atlanta Airport and the machine crashed into a ditch, an almost complete washout, although neither of the crew was hurt.

Within a few days, Hawks had secured another Gamma in Kansas City and started Richard Merrill, crack Eastern Airlines pilot south with it Accompanied by Klenke Merrill reached the Canal Zone on the 15th, Lima, Peru, on the 17th, delivered it to the rescue expedition in Chile on the 19th

Pursuits Deferred

Air Corps decides to wait for next year's models

AS A RESULT of close study and exhaustive tests of pursuit planes submitted by various manufacturers during the last few months, it has been found that although the aircraft submitted represented a great advancement over the type of aircraft in present use, yet not one of those submitted in the competition completely met the desired attainments of the modern pursuit plane" Thus Harry H Woodring last month announced that the Air Corps had decided to order neither the Curtiss nor the Seversky single-seater pursuit which had been submitted last summer in competition for a contract expected to call for 82 planes.

Instead, the Corps looked forward to an opening of new proposals scheduled for April 15

Retirement of hundreds of "tactically obsolete" army planes from use by combat units of the Air Corps in the next eighteen months is announced by Brig Gen A W. Robins, Wright Field, chief of the materiel division

Planes over five years old, General Robins said, are referred to as "tactically obsolete," and of these the Army has 80 Keystone bombers, 55 attack planes, mostly Curtiss and Consolidated, and 186 pursuit planes, chiefly Curtiss and Boeing Though not ready to be scrapped, these planes cannot be counted as modern armament, and will be relegated to use of non-tactical personnel and trainees as replacements are made with Douglas and Boeing bombers and Northrop attacks Replacements also are needed in training, observation and transport planes

Exclusive of 103 new bombers, 115 new attacks and 82 pursuits to have been ordered by that date, Air Corps strength as of June 30 will be 1,342 planes

Calendar

Jan 29-31—Fourth Annual Meeting of the Institute of the Aeronautical Sciences Physics Building Columbia University, New York City.
Feb 1-9—National Pacific Aircraft and Boat Show, Pan Pacific Auditorium Los Angeles, Cal
May 15, June 1—International Aero Exhibition, Stockholm Sweden
Sept. 3-8—National Air Races Cleveland Ohio.
Oct 25—Paris-Saigon Air Race.

Student's Warning

Bureau of Air Commerce to crack down on passenger carrying by students and amateurs

THE FIRST court case in a drive by the Bureau of Air Commerce to cut down on illegal carrying of passengers resulted recently in a suspended 90-day jail sentence for Walter Campbell of Wantagh, Long Island

Because state prosecution was much simpler than procedure under federal law, the complaint was lodged by a member of the state police The charge was an infraction of the state law (which requires compliance with the federal regulations), and the sentence was passed by a Justice of the Peace presiding at a local police court, but it was none the less an action instigated by the New York representatives of the Bureau of Air Commerce as the opening of a drive on similar offenses

Campbell pleaded guilty to carrying an eleven year old boy as a passenger several months ago, although he held only a student's permit at the time The violation was discovered when the plane cracked up near Roosevelt Field, injuring both Campbell and the boy

Salesmen Meet

Stinson dealers turn out for annual conference at factory

TEN distributors of Stinson Airplanes flew away eleven "Rehants" in two groups in January and a score or more other dealers attended a Sales Convention held Jan 16-18 at the corporation's factory in Wayne, Mich

"The keynote of the Sales Convention this year," said B D DeWeese, president, "was planned selling We convinced our distributors that we had taken a leaf out of the book of the automobile manufacturers, the airlines and

other industries who have had the courage to increase advertising and sponsor intensive sales drives and they promised to cooperate

"We especially advocated the widespread use of statistical data proving the safety of modern aircraft such as the fact that our four-passenger planes built during 1933, 1934 and 1935 had flown more than 1,000 000 miles per accident in which a fatality occurred

"Selling will hit a new high this year" predicted Mr. DeWeese "and all of us must improve some of the hit and miss methods we have been forced to use and lead our distributing organizations in such a manner that they increase sales, lower sales cost per airplane, and become able to provide adequate servicing facilities for owners."

Under Ten Hours

Hughes breaks Turner transcontinental mark

Another 36 minutes was lopped off the transcontinental speed record Jan. 14 when Howard Hughes wealthy young oilman and film producer, flew a Northrop Gamma powered with a Wright Model G Cyclone from Burbank, Cal., to Newark in nine hours and 27 minutes.

Flying most of the 2,450 miles at an altitude of 18,000, he averaged 260 m.p.h. over the entire trip, hit 295 between Indianapolis and Columbus, Ohio. Frequently he was forced to take draughts from a tank of oxygen with which the plane had been equipped.

Leaving Burbank at noon Hughes had to fly by instruments much of the way from Burbank to Santa Fe, but encountered excellent weather conditions through the rest of his flight. He arrived at Newark at 12:42 a.m. (E.S.T.)

The former record of ten hours and three minutes had been set Sept. 1 1934 by Roscoe Turner

Men at Work

Boeing, Consolidated, Douglas, Northrop and Taylor list big payrolls. DC-2 roll call. Curtiss starts big mock up. Douglas gets Navy contract for 114 torpedo bombers.

From all over the aeronautical production map last month bulletins came of new and increasing production and the employment that goes with it

Boeing with its new order for thirteen 299 bombers announced it would get into production on them at once, that it planned to deliver the first ship of the contract in ten months, that it would have them all completed in eighteen months, that it would employ 1,500 men for the purpose

Consolidated, reporting the completion of the first ship from its new San Diego plant (a two-seat pursuit) on Jan. 15, announced its present payroll at 1,450 employees, a production schedule of ten planes a month for 1936

Northrop last month started building up its personnel to get under way on its big contract for attack planes, a task it estimated would run its Mines Field plant at near capacity for a year

Taylor at Bradford, Pa., finishing its 1935 production with its 210th plane released the figure of 150 700 labor-hours as its year's work total approximately triple the corresponding total for 1935

Waco has begun delivery on a recent order received from the Brazilian government for 40 Model F's and four Cabins. Some 158 Wacos are already in use in Brazil

Curtiss has disclosed that it has finished plans, a mock up and preliminary engineering work on a 40-passenger four-engined 25-ton transport at its Buffalo factory

Predictions from the Douglas factory where 5 000 people turned out in December for a Christmas party for employees and relatives estimate that that company's payroll may reach 4 000 during 1936, almost double last year's peak.

Jan. 20 the Bureau of Aeronautics of the Navy announced a contract had been awarded to the Douglas Aircraft Company for 114 low-wing monoplane torpedo-bombers specially designed for carrier deck operation. The total aircraft contract price was $3 636 000. No other details were released though it has been learned that the ships will be powered with Pratt and Whitney engines, probably 1830 twin-row Wasp seniors

Another Douglas item of interest—a roll call of its DC-2 deliveries to date shows the widespread success that model has achieved

DC-2 Transports owned in the United States

TWA	26
Eastern Air	12
Pan American	7
Pan American Pan-A	5
American	16
Swiftlite Aircraft Corp.	1
U. S. Navy	5
U. S. Army	1
Total	73

DC-2 Transports owned abroad

LOT Airlines (Poland)	2
KLM (Netherlands)	12
Australian Airlines	1
Deutsche Lufthansa (Germany)	1
Aeras Postales (Spain)	3
Swiss Airlines	5
Italian Airlines	1
Japan Air Transport	1
Chine Nationat	2
U. S. S. R. Government	1
French Government	1
Total	30

BOEING'S BIG BOMBER

coming in for a landing with flaps full down. With a contract in hand for thirteen of these 299's, the Boeing factory looks forward to a busy year

AVIATION'S *Consolidated Directory Number for March*

Timed earlier this year . . . to meet an awakened world-wide interest in American Aircraft . . . featuring in ONE Big, colorful issue *Airplanes . . . Engines . . . Accessories . . . Materials . . . Airport Equipment.*

IN TEXT and illustration, this advanced showing of America's 1936 aviation products will be the most complete guide and directory ever published

It will describe all 1936 commercial airplanes and engines, illustrated with photographs and three-way drawings, accessories, too, will be described and generously illustrated.

Every reader will be interested in the latest planes for transport, private or industrial use and in their design and performance . . . will want this invaluable storehouse of information for study and comparison

The entire aircraft industry has cooperated heartily in furnishing material for this advanced showing Editorially this will be a large and colorful issue of indispensable value to everyone interested in American aviation

MARCH AVIATION—including news, editorials and regular departments—will carry twice the usual number of pages.

. . . the consolidated directory . . . 46 pages in all will be printed on special stock

. . . the airplane section will feature 70 commercial planes, from the smallest sport model to a 25-ton, 4-engined transport.

. . . all available commercial aircraft engines; accessories, materials and airport equipment will be described and illustrated in separate sections

. . . detailed specification tables of airplanes and engines—an exclusive Aviation feature—will include all design and performance characteristics, equipment, materials of construction, methods of fabrication, etc. arranged for ready reference. These tables will be printed on heavy coated stock and, for the first time, as a loose folded insert which may be removed for mounting or for other easy reference purposes

. . . each section will be cross indexed by products and manufacturers

AN OPPORTUNITY FOR ADVERTISERS

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Adequate product advertising in the March issue by individual manufacturers will contact more than 15,000 paid-in-advance readers—the real buyers, at a cost of 1⅓c. per call. By every accepted test, advertising in *Aviation* is the most economical and effective method of supplementing direct sales efforts

With the prospects for profitable aviation business in 1936 greater than ever before for those who use well established sales tools, the March issue of *Aviation* offers the best low-cost way to get your sales story before buyers in every branch of the world market and keep it there for months to come.

This is your opportunity

. . . to tie in a strong sales message with an issue timed to advance the 1936 buying season in a thoroughly awakened world market

. . . to secure long-lived advertising value because your customers and prospects will keep MARCH AVIATION and refer to it frequently

. . . to insure your competitive position by inviting special attention to your own sales message.

. . . to be present when or where the buying is done, regardless of how your salesmen time their calls

Act now to profit by this concerted promotional effort.

Reserve your advertising space NOW

The March Consolidated Directory Issue of *Aviation* is not only an excellent time to start a regular advertising program, make special announcements, etc., but also offers an outstanding opportunity to maintain and multiply your sales contacts in America's Fastest Growing Industry through the medium of the oldest and most up-to-date American aircraft publication

Publication Data MARCH ISSUE

Total distribution over 17,000
Paid Circulation over 15,000, includes more than 1100 Canadian and Foreign subscribers . . Extra distribution to all important aviation executives in Latin-America. No increase in advertising cost although rates are based on 10,000 net paid circulation.

Closing Dates

Covers—February 19 Color Forms—February 19 Black and White Forms—February 20.

DON'T DELAY—Position assignments will be made as reservations are received

AVIATION • *A McGraw-Hill Publication* • 330 West 42nd Street, New York, N. Y.

AMERICA'S FASTEST-GROWING INDUSTRY

AVIATION *FOR* MARCH

AMERICA'S FASTEST-GROWING INDUSTRY

Schools, Services, and Airports

● ALABAMA—HUNTSVILLE is awaiting approval by Al Key, Department of Commerce district airport adviser, before taking steps to purchase the proposed municipal airport site on Whitesburg Drive. Acquisition of 75-acre field would make the city eligible for $48,326 of WPA funds, to be spent for a 60x80 ft. hangar, boundary lights, drainage and fencing.

● ARKANSAS—FORT SMITH is considering the purchase of Alexander Airport. . . . The Tech Landing Field at RUSSELLVILLE has been allotted $16 000 by the WPA for the construction of a hangar.

● CALIFORNIA—MONTEREY has applied for $40,000 in WPA funds for surfacing runways and constructing a hangar. . . . LONG BEACH has received funds from the PWA to shift the Naval Reserve Base from the west end to the east end of Daugherty Field. Work has already started on the construction of new runways. . . . A $259,000 WPA expansion and improvement project has been started at Chandler Field, FRESNO. . . . A board of naval officers has been inspecting possible sites for a naval air base in San Francisco Bay. The navy wants to locate the base at ALAMEDA, but the city has not yet turned over to the federal government land that it needs for the project. . . . Curtiss-Wright Technical Institute, GLENDALE, has recently placed 23 graduates and ex-students in positions in the aircraft industry. . . . Al Biederman, who operates an instrument repair shop at Grand Central Air Terminal, GLENDALE, reports a decided increase in business. . . . Donald Hall, designer of Col. Lindbergh's "Spirit of St. Louis," has rented a building at Lindbergh Field, SAN DIEGO, where he is engaged in experimental work.

● COLORADO—The City Council of DENVER has passed a bill to prohibit night flights over the city between 10 p.m. and 6 a.m., except on flights to or from a point 25 miles or more away.

● CONNECTICUT—The State Aviation Department is promoting a plan to give free ground school instruction to persons eligible for adult education under the WPA. If the plan is approved, schools will be established in ten cities including HARTFORD, NEW HAVEN, BRIDGEPORT, and DANBURY.

● FLORIDA—The WPA will construct a $44 000 steel and sheet metal hangar at Peter O. Knight Airport, TAMPA. Mayor Chancey expects an additional $100 000 appropriation for an administration building.

● GEORGIA—Ware County Airport, WAYCROSS, is having lights installed. A new hangar is almost completed, and the field will be graded. . . . A group of Southern pilots is planning a tour of a dozen cities, starting from ATLANTA early in February, and including in its itinerary JACKSONVILLE, CHATTANOOGA, and NEW ORLEANS. The entire fleet of fifteen or more planes will be Taylor "Cubs."

● ILLINOIS—WPA improvements at MOLINE Airport will cost $372,935. . . . H. H. Woeltjen, Beulah Caley and Arthur T. Pullen have incorporated the Aviation Products Company in CHICAGO to deal in planes and other aviation products. . . . The present cinder runways on CHICAGO Municipal Airport will be covered with crushed bluestone and 8 in. of asphalt. New runways and drainage systems are being installed, and the concrete aprons around the edge of the field are being widened. The work is part of a $522,698 WPA project that will employ up to 1,200 men till the middle of March. . . . The DECATUR City Council is considering leasing Decatur Airport if the WPA will grant $100,000 for improvements. If the plan goes through, the field will be leveled and two 3,000 ft. runways built.

TO get the best possible material for this department AVIATION has set up a wide and elaborate news gathering system. Even so there are many activities in progress at the country's countless airports about which we receive only indirect information. If you are an operator, a member of a club or fly at an active airport and have items of news suitable for this department mail them to us now care of the News Editor. Help us make this department as complete and accurate as possible.

● INDIANA—The Department of Commerce is considering establishing a radio beacon on Bendix Municipal Airport, SOUTH BEND. . . . Clyde Shockley is starting an aviation ground school course at MUNCIE that will last fourteen weeks. Tuition cost will equal the cost of three hours of flying instruction, and on completion of the course the student can take three hours of instruction gratis. . . . Robert F. Shank, president of Hoosier Airport, INDIANAPOLIS, has announced that George F. Gamsjager is now in charge of all training and the sales of new and used planes there. The airport is the local agent for the Taylor "Cub." . . . The FORT WAYNE Aero Club plans a series of three lectures on aerial navigation, to be delivered by Capt. Clarence F. Cornish. Next August the club will sponsor a second annual Northern Indiana Air Cruise.

● KANSAS—KANSAS CITY's request for $1,750,000 from the WPA for grading, draining and equipping Fairfax Airport has been refused. The city leases the field for $1 a year, and the WPA refused to grant money for the improvement of leased property. The city commissioners have said that they have no intention of acquiring title to the field.

● KENTUCKY—Harry Boggs, an Indiana pilot with fourteen years of flying experience, has leased the MIDDLESBORO Airport from the city. He plans to establish a flying school, and will erect a hangar and servicing station. Boggs is also promoting the formation of an aviation club in Middlesboro.

● MAINE—BANGOR will have passenger service to Boston, using 180 m.p.h. Lockheed Electras, if Boston-Maine Airways' requirements regarding improvements at Godfrey Field are carried out. The runways are too short for such fast ships. The Bureau of Air Commerce will install radio beam stations at Bangor, and the WPA and the state will install field lighting. PORTLAND needs a third runway before the service can be established. . . . Lyndon A. McMackin has forfeited his claims to the property BRUNSWICK is trying to develop into an airport. As long as he held a lease on the property, the WPA refused to grant money for development, but now the city feels that the last obstacle has been removed, and hopes for a $20,000 grant.

● MASSACHUSETTS — J Lester Holm, farmer-owner of Nobadeer Airport, NANTUCKET plans to erect a six-plane fireproof hangar on his field . . . PITTSFIELD has been offered the 112 acre tract owned by the Pittsfield Airport Corporation for $12 000 If the offer is accepted, the field will be eligible for $40 000 of WPA funds with which to widen and lengthen runways and build a hangar . . . WESTFIELD is considering spending $70 000 for clearing land and constructing three 500-ft wide runways, 3 500 3,200 and 2 600 ft long . . . Arthur Beaudoin and Joseph Fluet, owners of FITCHBURG LEOMINSTER Airport, have bought a four-place Stinson cabin plane, equipped for night and blind flying They own another Stinson four-seater, used for taxi work and short hops, a States monoplane and also a biplane . . . The WPA has released $182 000 for improvements at SPRINGFIELD Airport The city hopes to recover airmail and passenger service, lost when the Bowles-Agawam Airport was converted into a race track

● MICHIGAN—Wayne County Airport, DETROIT, has its new Department of Commerce radio station in operation after a month of testing and adjustment The station which operates on a frequency of 230 kilocycles was formerly at Jackson . . . Marquette County Airport, NEGAUNEE will have a new hangar built with WPA funds . . . As outlined by Col Floyd E Evans state department of aeronautics head the state airport program calls for expenditure of $1,681 074 and will employ 2 850 men. Twenty-seven airports will have new hangars and thirteen cities will have new airports

● MINNESOTA—An airport for forest patrol planes will be built at MARNOMEN with $6 765 of WPA funds . . . The newly organized Cloquet Aviation Club met in CLOQUET late in December to hear W M Miller speak on weather conditions and their effect on aviation Officers of the club Francis M. Johnson, president, John Buskala secretary . . . F J Geng airport master at Holman Municipal ST PAUL, reported a 35 per cent gain in private flying and a 5 per cent gain in the use of air transport lines at the field in 1935 over 1934

● MISSOURI—Work has started on a new 900 ft east-west runway at the Municipal Airport POPLAR BLUFF . . . ST JOSEPH is developing a new airport on a 462 acre tract northwest of the city The hangar and lighting equipment will be moved from Rosecrans Field, two miles east of the new field The project will cost more than $200 000

● MONTANA—The south part of MISSOULA Airport will be graded and the southwest-northeast runway will be leveled with $6,000 in WPA funds

● NEBRASKA—The State Aeronautics Commission organized under a law passed by the Legislature in 1935 has formulated a comprehensive set of rules governing the registration, inspection and operation of aircraft, and the licensing of pilots, landing fields aviation schools, and mechanics . . . The Aerial Transportation Committee of the OMAHA Chamber of Commerce will renew its fight to have Congress make an appropriation to install lights on the OMAHA-BISMARCK N D and TWIN CITIES airways . . . Two hundred men are reconstructing the drainage system at OMAHA Municipal Airport, as part of a $174 000 WPA project

● NEVADA—The LAS VEGAS Chamber of Commerce is backing the plan for Las Vegas to acquire a municipally owned airport It has sent its report to the Bureau of Air Commerce for consideration The city has already bought a large tract of land for the purpose.

● NEW JERSEY—The CAPE MAY County Board of Chosen Freeholders is seeking WPA money for improvement of the Cape May Naval Air Station The field is at present without runways . . . The TEANECK High School Aeronca has returned to Teterboro Airport where instruction of the students will be continued

● NEW YORK—The Pegasus Flying Club whose plane is hangared at Floyd Bennett Field BROOKLYN is giving a series of lectures on meteorology navigation and the mechanics of flying . . . ROCHESTER has begun condemnation proceedings to acquire 193 acres of land as an addition to the Municipal Airport . . . The WPA is cleaning drainage ditches burying wires, and leveling the parking area at SCHENECTADY County Airport According to Assistant Manager George C Haven work on the runways and aprons will be started in the spring . . . The HEMPSTEAD Town Board has received an application for a change in zoning to permit construction of an airplane factory and flying field near the Aviation Country Club

The City of HORNELL has purchased Hornell Airport from Hornell Airways, Inc, for $7 500 the amount of the corporation's mortgage The corporation is now considering disbanding . . . The State Aviation Commission in its annual report to the Legislature last month, recommended the creation of a permanent department to foster civil aviation in the state

● NORTH CAROLINA—The hill in the northwest corner of Miller Airport, WINSTON-SALEM is being leveled and the dirt used to lengthen one of the runways Red Harmon has a new black-striped yellow Taylor "Cub"

● OHIO—DAYTON is considering a bond issue to finance purchase of Dayton Municipal Airport, VANDALIA to make it eligible for WPA improvements TWA has indicated that it would consider stopping at Dayton if the field were made suitable for the landing of large planes . . . Lunken Airport, CINCINNATI will have a new brick and stone terminal building to be constructed in cooperation with WPA at a cost of $97 818 . . . Lake Erie College, for women at PAINESVILLE is offering an aviation course, including ground training

MEMBERS AND MASCOT

of the Rollins Air Club of Rollins College line up at the Orlando (Fla) Airport Left to right Joseph M Lichtenstein Donald A Reed Anos R Smith Charles R Lantz Wilson I Mills instructor Dorothy Freedman James N Lambert Edward Strongin Marilyn Tubbs Constance R Righter, Franklin L. Roberts, and John Renaud II who is holding "Satin" an indigo snake, the club's mascot

ing, elementary engineering, and lectures by pilots and weather bureau officials. Instructor Philip A. Meinke . . . Joseph C. Mackey is rebuilding two Laird planes at Linco Airport, FINDLAY. He hopes to enter them in the Thompson Trophy Race at the National Air Races, Cleveland, this fall. . . . Kenyon College, GAMBIER, will have a new airport as a gift of Wilbur L. Cummings, an alumnus. The field will cover 120 acres, and will have 3,000 ft. runways and a modern hangar.

● OKLAHOMA — The OKLAHOMA CITY Aviation Club has appointed Joseph L. Neyer, A. A. Wild, Jr., George Qualls, Jerry B. Sass, and Joel C. Bates to a committee to draft plans for the establishment of a system to prevent the erection of obstructions in the vicinity of state airports.

● OREGON—Herman Hobi, who has managed EUGENE Airport for seven and a half years, has dissolved the Hobi Air Service, Inc., and will go to Aberdeen . . . Aviation ground courses for adults will be offered in nearly a score of Oregon cities through the cooperation of the WPA and the state department of education. Two-hour classes will be held two nights a week, the entire course taking six months. . . . The state-sponsored ground-school course being conducted at Swan Island Airport, PORTLAND, has raised a storm of protest from licensed mechanics, who feel that as they have paid for their own education, the free course is unfair competition. The protesting mechanics will send a committee to confer with the state officials to try to find a solution. . . . The DALLES City Council has been notified that unless it acquires title to Walter E. Case Field, the WPA will withhold $12,000 allotted for improvements there. . . . James L. Meadows, chief pilot of the Portland Air Service, SWAN ISLAND, brought a new radio-equipped five-place cabin Waco from the factory in Troy, Ohio, in December . . . A seaplane ramp is being constructed at NORTH BEND with a $55,000 WPA fund.

● PENNSYLVANIA — WASHINGTON County commissioners have voted to contribute $20,000 to the city of Washington for acquisition of an airport site, so that $155,000 in WPA funds may be obtained for construction work. . . . The City Council requires, however, that the county assume responsibility for any cost in excess of $20,000. . . . The Department of Commerce has approved the expenditure of $105,000 for improvements at Keystone Park Airport, EMPORIUM. . . . If plans for a $40,000 WPA project go through, TOWANDA State Airport will have a new 2,000 ft. runway 75 ft. wide, in addition to lighting equipment and grading and drainage improvements. . . . A new road from the main highway to the field is being constructed at Splane Memorial Field, OIL CITY, and wooded areas on the edge of the field are being cleared. . . . The Bureau of Air Commerce has approved plans for the expenditure of $105,000 more to erect a hangar, grade the field, and install a lighting system. . . . The Aero Club of Pennsylvania has elected Percy Pierce president and Victor Fritz secretary. Both are from PHILADELPHIA. . . . With his term of office drawing to a close, the Aero Club of PITTSBURGH has asked the county commissioners to retain Halsey R. Bazley as manager of the Pittsburgh-Allegheny County Airport.

● RHODE ISLAND — Living accommodations for five men and a five-car garage will be built on the state airport, HILLSGROVE. . . . The state police and the state airport division are supplying the material, while the WPA is supplying labor. . . . The Bureau of Air Commerce will install a $17,000 radio beam station at the field, scheduled to be operating by spring.

● SOUTH CAROLINA—AIKEN has applied for WPA funds for the construction of a hangar at the Municipal Airport to cost about $11,000. . . . Another project, already under way, will improve the runways at the field.

● SOUTH DAKOTA—Mayor A. N. Graff, of SIOUX FALLS, has appointed a committee to investigate methods of obtaining WPA improvements for Sioux Skyways Airport. . . . Discontinuance of airline service has been threatened because of the lack of hard-surfaced runways, adequate hangars, and a field lighting system.

● TENNESSEE — NASHVILLE's new airport, now under construction, will be named Nashville Municipal Airport. . . . Will T. Cheek, chairman of the airport committee, said that there were sufficient springs on the 334 acre field to assure an adequate water supply. . . . CHATTANOOGA Airport will have a new hangar, tripling storage space at the field, as one result of a $300,000 improvement project. . . . John F. Lanier has a new Great Lakes trainer, making five of that type at the field. . . . Karl Kurth reports several new students have enrolled at the Chattanooga Flying School.

● TEXAS — GEORGETOWN has bought 100 acres of land 1 mile east of the city to develop into an airport. . . . Seventy acres at the same site have been used for two years as an airport by the Gray Wings Air Service. . . . SAN ANTONIO has authorized a $350,000 bond issue to secure $3,500,000 in WPA funds. . . . Part of the money will be used for improvements at Winburn Field.

● UTAH—The Department of Commerce has approved the allotment of $34,869 for airport improvements at PROVO, $16,000 for RICHFIELD, and $34,850 for SALT LAKE CITY. . . . Work now being done at Salt Lake Airport includes construction of concrete aprons and improvements in the drainage system. . . . Salt Lake City has applied for a total of $235,000.

● VERMONT—BARRE and MONTPELIER City Councils have agreed to submit Airport Plan No. 2 to their respective citizens. . . . This plan calls for expenditure of $31,000 by the two cities, and would secure $47,000 from the WPA. . . . Under the plan, two drained concrete runways would be installed, and repairs and alterations would be made to the buildings. . . . National Airways is planning permanent service from the port, and would be willing to sign a ten-year agreement that no further improvements would be asked if the present plan goes through. . . . ST. JOHNSBURY has voted to spend $10,000 for the erection of a hangar at the municipal airport.

● VIRGINIA — Ralph W. Howe, of RICHMOND, has been elected Virginia governor of the National Aeronautic Association. . . . The Virginia State Planning Board has recommended that the entire state be mapped by aerial photography, pointing out that present maps of the state are incomplete and inaccurate. . . . The Town Council of WARRENTON has taken an option on the Myers farm on the Remington road, for development into an airport. . . . Mrs. Robert L. McKee, of FORT LEE, has bought a new Simson cabin plane. She plans to use the plane in operating a charter service.

● WASHINGTON—The WPA is constructing a 400x2,000 ft. cross runway at ARLINGTON Airport. . . . It will cost $9,696. . . . A $35,000 WPA project for improving the airport at BLAINE has been approved. . . . The project calls for clearing and grading the land and erecting a beacon light. . . . OLYMPIA Municipal Airport has been allotted $85,607 by the WPA. . . . Two of its three runways will be widened from 300 to 500 ft., with a 200 ft. wide center strip surfaced. . . . They will be lengthened to 3,000 and 3,400 ft. . . . Runway lights, landing flood lights and obstruction lights will be installed, and a 100x80 ft. hangar erected.

● WYOMING—The National Association of State Aviation Officials held one of its district meetings of the North Central States in CHEYENNE in January. . . . The Bureau of Air Commerce has approved expenditure of $9,804 for a field lighting system, terminal building, telephone line and road at RAWLINS Airport.

Aviation People

• RALPH S DAMON, whose resignation from Curtiss Aeroplane and Motor Company to join American Airlines was announced last month, has been elected vice-president in charge of operations for that airline. Mr Damon, now 38, graduated from Harvard in 1918, served as a lieutenant in the Air Service during the War, joined Curtiss in 1922 as an engineer. As vice-president, then president of the Curtiss Wright Airplane Company of St Louis, he had much to do with the design and production of the Robin, Junior and Condor planes. The conversion of the last named type to a sleeper transport for American Airlines was directly under his charge. After two years as president of the St Louis company, he became president of the Curtiss Aeroplane and Motor Company of Buffalo in 1935.


Ralph S Damon

• FREDERICK W NIELSON, connected with Sikorsky Aviation in an executive capacity for more than five years, has relinquished his duties there to accept the vice-presidency of United Aircraft. Mr. Nielson, who served as president of Sikorsky until that company was absorbed into the United Aircraft corporate structure last year, occupied the position of general manager for Sikorsky at the time of his recent promotion. He will be in charge of sales for the entire United Aircraft group. His successor at Sikorsky will be E. E. WILSON, R. W. CLARK becoming assistant general manager in charge of works.


Frederick W Nielson

• SECRETARY OF WAR GEORGE H. DERN has announced the promotion of BRIG. GEN. HENRY H. ARNOLD to the post of Assistant Chief of the Air Corps. General Arnold brings to his new post experience gained in one of the longest and most distinguished flying careers in the Air Corps. In 1911 he learned to fly at the Wright Aviation School in Dayton. In 1912 he was designated the first winner of the Mackay Trophy. He served through most of the World War as director of training in this country. In 1934 he capped an outstanding post war service by commanding the massed bomber flight to Alaska and return, a feat which won him the Mackay Trophy for the second time. Since the organization of the GHQ Air Force last January he has been in command of its First Wing, with headquarters at March Field, Cal. He will be succeeded there by COL. HENRY B. CLAGETT, who will be advanced to the temporary rank of Brigadier General. Another promotion of GHQ interest is that of COL. HERALD C. BRANT, commander of the Third Wing (headquarters at Barksdale Field, La.), who has also been given the temporary rank of Brigadier General.


Gen Henry H Arnold

• ORDERS were issued last month to COMMANDER ALFRED E. MONTGOMERY, U.S.N., detaching him from duty in command of the Naval Air Station, Anacostia, D. C., for service with the staff of the Commander Aircraft Battle Force, VICE-ADMIRAL HENRY V. BUTLER. LIEUT. COMMANDER KNEFFLER McGINNIS will act as commanding officer of the Anacostia Station until late spring. SECRETARY SWANSON later announced a number of impending changes in high command, some of which are of prime interest to the flying personnel of the Navy. Vice-Admiral Butler will be relieved in June by REAR ADMIRAL FREDERICK J. HORNE, now commanding Aircraft Base Force, U. S. Fleet. REAR ADMIRAL ERNEST J. KING, now Chief of the Bureau of Aeronautics, will take Admiral Horne's post at that time. No announcement has yet been made of Admiral Butler's new assignment nor of the identity of Admiral King's successor.

• The Herbert Schiff Memorial Trophy, awarded to the commander of the Naval flying squadron with the record for the largest total of hours flown without accident during the past fiscal year, was presented last month to LIEUT. PHIL L. HAYNES, Commander of Training Squadron Two, stationed at the Naval Air Station, Pensacola, Fla. In qualifying for this trophy, Training Squadron Two flew a total of 18,699.75 hours from July 1, 1934, to June 30, 1935. Scouting Squadron One, attached to the U.S.S. Ranger and commanded by LIEUT. COMMANDER M. F. SCHOEFFEL, stood second with a total of approximately 6,100 hours of flying. Scouting Squadron Two, attached to the U.S.S. Saratoga and commanded by LIEUT. COMMANDER FELIX STUMP, stood third.

• ROBERT R. OSBORN, since 1934 chief engineer of Curtiss Aeroplane and Motor, has been made consulting engineer for that firm. In explaining Osborn's new duties RALPH S. DAMON, at that time Curtiss president, said, "there is an increasing necessity . . . for a consulting engineer with duties of keeping informed on the latest advancement in aircraft design in this country and abroad, making studies for the determination of future engineering problems and cooperating in new basic designs." Mr. Osborn, a graduate of the University of Pennsylvania, served as project engineer for Curtiss from 1925 to 1934, and was the designer of the Tanager, winner of the Guggenheim safety competition. AVIATION readers have known him for years as author of "Side Slips." DON R. BERLIN has been appointed chief engineer to succeed Mr. Osborn and Fred Flader has been promoted to the post of assistant chief engineer. Both were project engineers for Curtiss. Mr. Berlin had once served as chief engineer for the Northrop Corporation.

• MAJOR HEZ McCLELLAN has been named to succeed the late MAJOR PLOYER P. HILL as Chief of the Flying Branch, Wright Field, Dayton. Major McClellan served as a private, then as a Second Lieutenant in the Signal Corps during

the War, then in 1920 transferred to the Air Service. Last summer he was an advance officer for the Army's mass flight of bombing planes from Washington, D. C., to Alaska.

• The National Aeronautic Association held its annual convention in Washington Jan 6 and 7. On the evening of the opening day there was a dinner at the Mayflower Hotel, to hear speeches by the retiring president SENATOR WILLIAM G. MCADOO, GEORGE S. WHEAT, vice-president of United Aircraft, and FRED D. FAGG JR., secretary of the National Association of State Aviation Officials; 1935's big crop of American international record holders received certificates from the FAI in recognition of their achievements.

In the election of officers, SENATOR MCADOO, president for a year, stepped down in favor of CHARLES F. HORNER, of Kansas City. Mr. Horner is editor of the *National Aeronautic Magazine*, official organ of the association, and until elected president of NAA was executive assistant to Mr. McAdoo. He has been law student, rancher, Chautauqua organizer, patron of the arts, public speaker, presidential campaign organizer, and publicity director for the NRA's Blue Eagle drive in 1933.

MAJ ALFORD J. WILLIAMS, ex-Navy flier who quit because sea duty took up too much of his time, was elected vice-president. He is now a reserve officer in the Marine Corps. Last year he continued to prove himself one of the country's best acrobatic fliers by his stunt-flying at the National Air Races in Cleveland and the All-American Air Races in Miami. He flies a special Curtiss Hawk for the Gulf Refining Company.

The new secretary is LOUISE THADEN. Miss Thaden is one of four women pilots working with the Bureau of Air Commerce in its program for air marking cities and towns all over the country.

An international flying record holder has been named treasurer. He is BEN KING, of Washington, who since last June has broken seven records in the two lightest seaplane categories flying pontoon equipped Aeroncas.

Side Slips

By Robert R. Osborn

"PATENT POOLS IMPERIL NATION, WITNESS SAYS" (Washington *Post* headline)

You may remember that a short time ago we decided to make early application for enlistment in the cavalry, thinking that to be one of the safer places to spend the next, and fast approaching, war. We have now come to the conclusion that we aren't even going to wait for the next war to come along but have

already opened negotiations for a private South Sea island, completely equipped with the proper number of palm trees, babbling brooks, beach combers, dusky beauties and a missionary, but totally unfit to serve as an Army or Navy base for any nation. We have, personally, seen the Marines practice coming ashore and getting the situation in hand, and we shouldn't care to have those lads muscling in on our private show.

The reason for our great haste in heading for the cyclone cellar is that it now seems that our nation is beset on all sides and from within. We had been taught all along to expect some greedy foreign country to come along and pull a Joe Louis on us in about four rounds. While a little alarming, this was all vague enough that we thought it would be a matter of years at least before the debacle was upon us. But, recent disclosures have shown us that we should have been worrying all along about J. P. Morgan and Co., the mid-West farmers who now might not be paid for the ham and cabbage they didn't raise, the inflationists, the Townsendites, the PWA workers who are painting allegedly depressing murals in our high schools, and even a patent pool. In fact, this particular witness about the patent pool states that "Patent pools have left America defenseless against any foreign power except Canada which has an aerial bombing force of only two planes, built in 1923."

Ah, these are indeed troublous days, lads, the times are out of joint, and we'd advise following our example as soon as possible. However, go find your own South Sea island, and don't try to intrude yourself in on our private one, for we warn you that it will be amply protected by two JN-4H training planes, built in 1917.

WE SEE by the papers that Army flyers have been trying to save valuable property in Hawaii by dropping bombs on

the lava stream issuing from Mauna Loa, hoping thereby to change its course. No chance here to plant dynamite charges ahead of time to insure accurate dropping of the bombs on the targets, as the boys used to do at the early air race meetings—when the public had to be impressed with the accurate bombing of the cardboard villages.

WE ARE very glad to see that one of the best newspaper "scoops" of the year—concerning the departure of the Lindberghs from this country recently, was scored for the New York *Times* by "Deac" Lyman, or more formally, Lauren D. Lyman. In 1927, we were at the old Curtiss Field on Long Island, "covering" the transatlantic flights for the World's Best Aeronautical Magazine (Adv.), and so became very well acquainted with the flock of reporters from the New York papers, who were also sent out there to cover the flights. For good luck "Deac" always wore a battered black felt hat he found in the grandstand after the Tunney-Dempsey fight in Philadelphia. Our first recollection of him was seeing him come out the side door of the Curtiss hangar, wherein was housed the Spirit of St. Louis, pushing the battered hat to the back of his head in a puzzled manner. Seeing us he said, "Say, I've got to 'phone in a story right away and I wonder if you'd straighten me out on something? Captain Lindbergh says that he has to make some minor repairs on his aileron. What the hell is an aileron, anyway?"

WE ARE glad to say that Deac continued his aeronautical education in a diligent manner and soon became one of the really informed writers in this country on such matters. He can now tell us more about the complex political and financial matters which go to make up the aeronautical world, than any of us could tell him about the gadjets and thingumjigs which make an airplane percolate (or not, as the case may be).

AVIATION SCHOOLS

WHERE TO BUY

NEW EQUIPMENT—ACCESSORIES—MATERIALS—SUPPLIES

Classified Advertising

0 CENTS A WORD $2.00 MINIMUM

Planes, Engines & Parts For Sale

ENGINES AND PARTS for sale Liberty 400 hp Hispano E 180 hp, Packard 800 hp The Vimalert Company Ltd 941 Garfield Ave Jersey City, N J No 1

OX TRAVEL AIR Detachable engine mount Just being re-licensed $500. Can locate ball Aviation Associates Inc Curtiss Airport, East St. Louis Illinois No 2

FOR SALE OR TRADE OX 5 American Eagle licensed to Aug 1936 Will accept any reasonable offer Will pay difference for better ship Michael Messina 410 So Main St Old Forge Pa No 3

HISSO MODEL A AND E ENGINES rebuilt in our own plant $60 up Send for descriptive list Complete stock of Hisso Curtiss OX 5 and Liberty parts Send us list of your requirements Complete machine shop service on all types of aircraft engines Heckman Machine Works 4026 W Lake St Chicago Ill No 4

OX 5s: New cylinders, overheads pistons bearings completely reconditioned rod block tested. LeBlond 60 overhauled Lewis Holy Name School of Aeronautics Lockport Illinois No 5

NEW AIRPLANES $25.00 down easy payments 7.00x4 Air Wheels with hubs $16.00 per set Propellers $2.98 up Send 25c for information Hibbs Fort Worth Texas No 6

EDO 3300, 2260 PONTOONS with struts for Robin—Waco Cabin—F2—F Challenger Robin Landplane Seaplane Electric starter blind flight instruments Mississippi Airways, Davenport Iowa No 7

125 H P KINNER BIRD For Sale 4 place, 260 total hours on ship and motor Now equipped with Edo Pontoons and water rudders 160 hours since major motor overhaul 15 hours since ship was completely dismantled overhauled and recovered Mechanical condition as good as new ship appearance far superior to factory finish Equipment includes Airwheels Brakes Heywood Starter, Switlik Chute, Air Speed turn and bank rate of climb. Licensed to July 15, 1936 on land and sea Insured through March 1936 Always kept in private hangar on fresh water Considered by many prominent pilots best BIRD ever built $2 600. Ship and equipment originally cost over $8 600. No trades FS-306 Aviation 330 West 42d Street New York City No 8

STEARMAN C-3 R, Wright J-5 7 engine excellent condition, Toro & Brek Landing and Navigation lights, Less radio Licensed Dec. 1 1936 $1850 Aviation Associates Inc Curtiss Airport, East St Louis Illinois No 9

FAIRCHILD 24 Cirrus Cabin never cracked, dual control new motor 25 hours ship time 400 hours. Consider trade Descomb 9 Crystal Drive Wethersfield Conn No 10

February 1936 Issue

Classified Advertising INDEX

REPAIRS—CONSULTATION—SALES—SERVICE—Peter Propeller Service North Beach Airport Jackson Heights New York City Telephones Garden City 5768-M, HAvemeyer 4-9500 No 11

PARTS FOR WARNER COMMANDAIRE Motor cowl, landing gear oil tank wing struts fuselage Waco 10 parts Fin stabilizer right and left elevator, rudder Pitcairn Autogiro PCA 2 parts set rotor blades head complete fuselage wings tail group, landing gear Jerry Kelsey Philadelphia Municipal Airport Philadelphia, Pa No 12

BELLANCA SKYROCKET In A 1 condition Equipped with wheel pants and radio License just renewed A good buy Western Light & Telephone Company, Huron Bldg Kansas City, Kansas. No 13

CURTISS ROBIN OXX-6—air wheels Gardner Prop 12 hours since major—just licensed Details on request Roy Vinings 1875 Weck, Youngstown Ohio No 14

WARNER ARISTOCRAT 3 place cabin plane completely reconditioned and recovered, motor majored, prop etched, hand rubbed finish on plane, $1 500 Jerry Kelsey Philadelphia Municipal Airport Philadelphia Pa No. 15

J 5 MONOCOACH—A 1 condition—150 hrs since major—full set instruments for blind flying—air wheels and brakes—exceptional bargain Art Jones City Airport Youngstown Ohio No 16

MONOPREP—Velie, just majored wing and tail recovered ready to fly away Jack Remsen 78 Parkhurst St Newark N J No 17

BEECHCRAFT DEMONSTRATOR Five hundred hours total time Motor 315 hours Special equipment Radio landing lights flares turn and bank rate of climb seventy gallon tanks Newark Air Service, Inc Newark Airport Newark N J No 18

100 PLANES $78 up—terms trades instruction Big Wholesale Directory 25c postpaid. A Practical Course in Aerobatics fully illustrated complete $1 Aircraft Directory Athens Ohio No 19

STINSON T Tri-motor licensed till Jan 1937, A 1 condition throughout, full air wheels, radio bank and turn rate of climb starters 11 passengers, real bargain at $2 100 Overhauled J 5 motors like new $400 OX Travel Air $475 Kinner Bird $975 Mulzer Norton Field Columbus Ohio No 20

WASP-POWERED all metal Flamingo Just relicensed as eight place, flares landing lights blind flying instruments, radio electric starter generator new modern upholstery dual controls A high-performing airplane priced to sell Baker's Consulting Bureau South Bend Indiana No 21

OX 5 CURTISS ROBIN $350. Licensed steel propeller new tires dual controls never cracked up Two owners since new Re-covered last Fall New engine log 38 hrs Ship log 345 hrs Airport Williamsburg Va No 22

(Continued on opposite page)

CLASSIFIED ADVERTISING

10 CENTS A WORD — $2.00 MINIMUM

Continued from page 78

AIRCRAFT SALVAGE EXCHANGE two three and four place, closed and open planes for sale New and used motor parts, airplane parts and supplies bought and sold Wrecked planes and parts taken in trade Ships rebuilt and refinished Gov't approved repair station No 118 Pioneer Aircraft Co, Teterboro Airport Hasbrouck Heights N J No 23

WACO CUSTOM De Luxe Demonstrator Jacobs powered Less 100 hours, Less six months old Like new Beautiful finish Many extras Cost over $7 700 Will sacrifice for quick sale The H C. Robbins Company Cleveland Airport, Cleveland Ohio No. 24

2 VELIE CYLINDERS with valves, $10 each gear-case with gears and cam $15 oil pump $5 master and connecting rods $15 M Emling 1527 Bewick Ave, Detroit, Mich No 25

WACO F Kinner B5 Completely recovered Engine overhauled this summer Excellent condition High gloss finish FS-311 Aviation, 330 West 42d St New York City No 26

BALSA WOOD ½ price 100 cubic inches of any sizes 25c Send sizes wanted Mail Order Department Keho Aircraft Company 5712 Woodlawn Ave Chicago Illinois No 27

STINSON S Black and Silver, Leather upholstery—New Semi Airwheels Bank and turn $1 750 Other ships for sale. 24-hour Charter Service Approved Repair Station No 47 Eastern Aeronautical Corp Airport Newark N J No 28

AERONCA CABIN 1935 demonstrator, 4 mos old, like new Aircraft Service, Inc, Cleveland Airport Cleveland Ohio No 29

NEW J5 EXHAUST RINGS $55.00 up, new Kinner exhaust manifolds $35.00 up new Wasp exhaust rings $75.00 up new J6 rear exhaust $65.00 up Engel Aircraft Specialties, Glendale Calif No 30

LOCKHEED VEGA Wasp C Engine Full air wheels and tail wheel $5,000.00 Bellanca Pacemaker J 6 330 Wright $3 250.00 Commandaire Axelson Engine $1,250.00 Aeronca 2 place, $800.00 Raymond Aircraft Co Macon Georgia No 31

FLIGHTEX WING COVERS Commandaire, Waco Travel Air Swallow American Eagle $16 Fuselage covers $12 Others proportionately Dope $1 25 gallon, thinner $1 25 gallon Ostergaard Aircraft, Peru, Indiana No 32

FOR SALE OR TRADE Fairchild 22 OK throughout $1,250 Porterfield like new $1,400 Ryan J-5 just completely recovered $1 450 150 hp Axelson Motor never flown $300, Stinson SM8A modernized and lately recovered $1 650 Challenger motor parts Factory reconditioned BG spark plugs 55 each Aviation Service Company Inc P O Box 32 Hartford, Conn No 33

DISPLAYED ADVERTISEMENTS

Attractive, Easy to Read, Convenient to Use, Saves Time, Costs Less

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The Need

The increasing use of airplanes developed a situation akin to that in the automobile field It requires the disposal of a constantly increasing number of used planes and a corresponding volume of engines parts accessories—in fact every kind of aeronautical equipment

The Market

The selling of used planes as compared with used automobiles differs greatly in one respect. Used cars are sold almost entirely in a local market used planes can—and must—seek a national market. Therefore a national business paper of the industry—AVIATION—becomes the logical medium for offering used planes for sale

The Service

The advertising of used planes engines, parts, etc., naturally finds its place in the classified advertising columns of a business paper along with other advertising of services offered or wanted and the hundreds of other business wants of subscribers However the old forms of classified advertising are not practical for any volume of this advertising as it is now developing in the field of aviation

The NEW Service

AVIATION—as the oldest American aircraft publication serving the industry—has therefore developed a new form of classified advertising especially suited to the requirement of offering used planes in a national market. It is attractive, easy to read and, through the use of a newly developed plan of numbered advertisements and indexing the most convenient service ever offered for the use of both buyers and sellers.

Indexing

The indexing of planes for sale of engines, parts accessories and special services offered, of trade or wanted propositions is in itself a time saving convenience that will find quick appreciation among prospective buyers and react to the benefit of advertisers accordingly

Lower Cost

Even with the greatly improved form of this New Classified Advertising in AVIATION advertisers are offered the further benefit of rate reductions that will materially lower the cost. First insertions will be at the existing rate of 10 cents a word minimum charge $2.00 an insertion BUT—if additional insertions are required to locate buyers the following rates apply

Second insertions	8 cents a word
Third insertions	8 cents a word
Fourth insertions	7½ cents a word

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YOU can use this New Classified Advertising to good purpose to reach buyers or sellers among the close-to-16,000 other readers of AVIATION, for the items you have for sale or that you want.

Products

Instruments

SPERRY ARTIFICIAL HORIZON, overhauled, $175.00 Sperry Directional Gyros overhauled, $200.00 Wiley Flares, reconditioned, $25.00 Frank Ambrose, Inc Jackson Heights N Y

Services

Photography

PHOTOGRAPHY Supplying the demands of many large aviation concerns requiring quality photography Merle J Ottke Grand Central Air Terminal Glendale, California

Repairing

AVIATION CLOCKS watches and instruments of all kinds repaired W H Leydehmers, 330 E San Fernando Blvd Burbank Calif

INSTRUMENT SERVICE Mail your instruments for accurate factory test by factory trained experts Biederman & Mertin Instrument Specialists Grand Central Airport Glendale, Calif

Sales

AUTHORIZED SALES AND SERVICE Wright Lycoming Continental, Pratt & Whitney, Warner, Write Phone for Prices Export Sales and Service All type Engines and Parts Engine Air Service Inc., Roosevelt Field Garden City N Y

Wanted

WRIGHT J6 9 ENGINES wanted any condition Charles H Babb 1100 Airway, Glendale Calif

Position Vacant

EXPERIENCED Transport Pilot wanted to teach ground school on fee basis—also experienced A&E instructor fee basis Address all inquiries P 316 Aviation, 330 West 42d St, New York City

Position Wanted

Rate 5 cents a word $1 minimum

AUTOMOTIVE engineer, sixteen years experience in supervising drafting, specifications, standardization and production control, desires position in aeronautical industry in similar capacity PW-314, Aviation, 520 No Michigan Ave Chicago Ill

COMPETENT Aeronautical-Mechanical Engineer M.S single 28 Exceptional theoretical and practical engineering background Experience design, construction, Government aeronautical research radio synoptic meteorology, flying Domestic-Foreign PW-313 Aviation 520 No Michigan Ave, Chicago, Ill

ENGINEER—AVAILABLE

Engineering education Extensive aerodynamic design stress analysis and general design experience Designed successful airplanes Recently specialized in experimental development of new types General patent knowledge Consulting Engineering Desire good permanent position anywhere or temporary in California

PW 311, Aviation
532 Mission St San Francisco, Calif

Additional Advertising of Planes, Engines and Parts, Services, and Wanted See Page 80

Copy for Classified Advertisements in the March Issue Required by February 21st

Professional Services

Additional Advertising of Planes, Engines and Parts, Services, Wanted and Employment Opportunities—See Pages 78-79

INDEX TO ADVERTISERS

Wherever you fly, by airline, *Eclipse* reliability flies with you

Significant and outstanding is the use of Eclipse Equipment by every air transport line in America — a distinction which carries high responsibility. Scheduled day and night flying demands mechanical and electrical excellence of the highest order. Eclipse equipment, we believe, fulfills these requirements to the greatest possible degree. Continued development, improvement and invention keeps Eclipse equipment always in advance of the industry's needs.

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EAST ORANGE, NEW JERSEY
{Subsidiary of Bendix Aviation Corporation}

ECLIPSE MANUFACTURES:

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Detailed data gladly supplied upon request.

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